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# SYPHILIS AND THE NERVOUS SYSTEM

FOR

PRACTITIONERS, NEUROLOGISTS  
AND SYPHILOLOGISTS

BY

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AUTHORIZED TRANSLATION FROM THE SECOND  
REVISED AND ENLARGED GERMAN EDITION

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SOLDIERS' HOME, AND STATE HOME FOR CRIPPLED AND DEFORMED CHILDREN.

*98 ILLUSTRATIONS IN TEXT*

SECOND AMERICAN EDITION REVISED



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DEDICATED  
To His Teacher  
PROFESSOR WILLIAM ERB  
WITH REVERENCE AND GRATITUDE  
BY  
THE AUTHOR





## PREFACE TO THE SECOND EDITION

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IN the six years since the appearance of the first edition of "Syphilis and the Nervous System," important new discoveries have been added to this subject. The discovery of the *Spirochæte pallida* by Schaudinn, whose premature death has been a great loss to scientific investigation, the beginning and development of cytodagnosis, as well as the globulin examination of the spinal fluid, and finally the application of the complement-deviation method for the diagnosis of syphilis by Wassermann and A. Neisser and the utilization of these methods by neurologists, must deeply affect the theme "Syphilis and the Nervous System." The discussion concerning lues nervosa in the first edition was only briefly touched upon in a purely clinical manner. It now demands a thorough consideration, also the gradually increasing number of cases of recovery or of a quiescence of the symptom complex of paresis warns us that we, *mutatis mutandis*, must reconstruct our symptomatology and prognosis of that disease as we have already done for tabes. I have endeavored in the second edition to set forth these results of investigation and practice.

Since the entire arrangement of the material has proven to be a practical one, I have found no occasion to change the outline in its entirety.

The last six years have brought to me an abundant material of syphilogenetic diseases. I have used this material for illustration whenever it has served to bring out new view-points and in the discussion of old and new questions of contention helped to shed new light. Notwithstanding, the book maintains the character which I have desired to impart to it from the beginning, namely, the stamp of the personal, individual experiences of a clinician. The pertinent, in recent years extremely voluminous, literature I have reviewed as far as possible. I believe this time

that I have not omitted the consideration of the essential and important contributions to this subject.

I wish to thank my assistants for the support which they have given me. I desire to thank especially Doctors Apelt, Eichelberg, and Suntheim, without whose efficient and conscientious assistance I should not have been able to present the material for this book.

The book may be said to have been written out of the practice for the practice. For this reason I regard the citation of individual cases illustrating the form of disease described as indispensable. I have endeavored to present the case histories in as brief and concise a manner as possible with the hope that they will be carefully read. I hope also that the practitioner seeking for advice will find among them similar cases to his own. May the kindly reception which was given to the first edition by my professional colleagues also be accorded to the second edition.

DR. NONNE.



## TRANSLATOR'S PREFACE FOR SECOND EDITION

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THE second American edition of "Syphilis and the Nervous System" is a translation from the third German edition published in 1915. The changes in the new edition have been well stated by Dr. Nonne in the preface. In this he says that he has not seen fit to alter the general arrangement of his material, because the backbone of the study of syphilitic nervous disease lies now as formerly in clinical observation. The subject of symptomatology has, it is true, been greatly enriched by the new cytological, serological, chemical and pathological contributions to it, without undergoing any essential change. The new material in this edition deals chiefly with these new contributions. Naturally then, the principal changes in this edition occur in the chapters on paresis, tabes, the sero-biological reactions and therapy.

CHARLES R. BALL.

ST. PAUL, MINN.  
May 1, 1916.



## TRANSLATOR'S PREFACE

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WHILE a student of Dr. Nonne's in Hamburg, I conceived the idea of translating his book "Syphilis and the Nervous System" into English. The book as an authority on this subject stands very high in Germany and has been translated into Italian. I have endeavored to present the subject matter of the original in a somewhat briefer form in the translation. In order to do this I have omitted in the translation chiefly two things: first, extensive references to different authorities, and, second, many case reports. The subject matter itself has been shortened very little.

Since the subject of the book "Syphilis and the Nervous System" is in such a state of transition at the present time, due chiefly to the four reactions and salvarsan therapy, Dr. Nonne has rewritten for this edition of his book the last two chapters of the original book on the four reactions, and has added a chapter on salvarsan therapy. This brings the whole subject up to date.

CHARLES R. BALL.

ST. PAUL, MINN.



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# SYPHILIS

## AND

# THE NERVOUS SYSTEM

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### I

### INTRODUCTION

**The Importance of a Knowledge of Syphilis of the Nervous System.**—We are going to deal in the following chapters with the theme “syphilis and the nervous system.” The subject is a very important one. In treating it, it will be necessary to consider almost the entire pathology of the nervous system. Much, corresponding to its importance, must be dealt with thoroughly, while some it will only be necessary to touch briefly in passing. A knowledge of this chapter of internal medicine is of great importance to every physician. The prophylaxis and therapy open up a wide and often thankworthy field, while, on the other hand, a failure to recognize the specific nature of a disease brings with it frequently far-reaching and disastrous results.

**The Increase of Syphilis.**—Is syphilis of the nervous system of frequent occurrence? The voluminous literature pertaining to this subject would lead us to presume that it was. Particularly the great increase of this literature in the last decade would cause one to think syphilis to be of more frequent occurrence than formerly. The hospital statistics on this point do not prove the contention. They merely indicate the greater tendency, on the part of the laity, toward hospital care, and for this reason more accessible information from hospital records. Reliable statistical knowledge of the distribution of syphilis is lacking. It can only be obtained when the physician is compelled to report such cases in the same manner as he does other infectious diseases.

During a journey in Montenegro, three years ago, it was very interesting to me to learn, from a physician of the country, that every syphilitic who presented himself to a physician for treatment must remain under medical control for a period of three years. If he withdrew from this supervision, upon command of the reigning prince he was interned for a period of three years, or until the syphilis in its infectious stage was considered to have terminated.

In a land where absolutism does not exist, and where the population is large, such means would not be feasible. Denmark, Norway, and Sweden are to my knowledge the only European countries which require a notification, on the part of the physicians, of sexual diseases. All cases of sexual disease there, without mention of the name, must be reported weekly to the government statistical office.

From the standpoint of reason, however, we can easily comprehend how syphilis might be more prevalent at the present time than formerly. It is a disease which is transmitted from person to person, depending to a large extent on human intercourse, which in the entire world has been greatly increased. More difficult conditions of life have also, from the poorer classes, driven more women to prostitution and withheld the men from entering into the marital state.

**Increase of Nervous Disease in General.**—That nervous disease in general has been on the increase is a well-recognized fact. The causes for this are various. The development of Germany into an industrial nation has caused a great increase in the proletariat, not including in this class the skilled workmen, but only the under laborer and the poorly paid laborer living in the poorer quarters of our large cities. One should also mention here the great army of nervous people who have been created by the accident insurance laws. Every physician who comes in contact with these cases knows that often these accidents form the starting point for different kinds of nervousness, and in the majority of cases, not the injury itself nor the series of nervous shocks which may surround it are responsible for

the resulting symptoms, but the fight for the insurance allowance makes, nowadays, the injured workman a nervous cripple. We may assume with reference to our theme *a priori* that in general a weaker nervous system is being subjected to a greater strain.

Rudolph Virchow in 1858, in his classical studies concerning the nature of constitutional syphilitic affections, came to the conclusion that syphilis in the body attacks by preference a *locus minoris resistentiæ*. Later investigations into this subject have only confirmed Virchow's deductions.

**Frequency of Syphilitic Disease of the Nervous System.**—In order to determine the frequency of syphilitic disease of the nervous system, one can make use of the statistics of practising neurologists. From 1892 to 1901 I have examined out of my private practice 5500 persons with nervous disease. From this number specific disease of the nervous system was diagnosed 85 times. Of other organic nervous diseases, there were 84 cases of tumor cerebri and 38 cases of multiple sclerosis. The review of the material at Eppendorf Hospital during the same ten years showed that from 72,180 patients, who were received into the hospital during this period, the diagnosis of nervous syphilis was made 282 times. Cases of tabes and dementia paralytica were not included in this list.

The objection that perhaps many cases of nervous syphilis had sailed under other flags and were placed in other categories is scarcely valid when we consider the character of the men who were working at Eppendorf during this time. They were such men as Eisenlohr, Kast, and above all Rumpf, whose book, "Syphilitic Diseases of the Nervous System," published in 1887, has been a landmark on the pathway to a better knowledge of nervous syphilis.

From 1903 to 1907, out of 5649 nervous patients seen in my private practice, I diagnosed nervous syphilis 88 times. During the same five years I saw 42 cases of brain tumor and 45 cases of multiple sclerosis. From 1903 to 1907 at my clinic at the Eppendorf Hospital I treated 9936 cases

of nervous disease and made the diagnosis of nervous syphilis 104 times. From my private cases from 1892 to 1901 the percentage of patients with nervous syphilis amounted to 1.5. At the same time from the entire number of patients received at the medical clinic at Eppendorf, the percentage was 0.4. During the last five years, from 1903 to 1907, from my private clinic the percentage was 1.5. At my clinic at the Eppendorf Hospital the percentage was 1. In recent years because of referred patients this percentage has been greatly increased.

One can see from these statistics that while nervous syphilis cannot be regarded as a relatively frequent nervous disease, yet it occurs about twice as often as tumor cerebri and multiple sclerosis. Hjelmman states as his opinion that brain syphilis develops in from 15 to 25 of every 1000 cases of syphilis. Reumont in his book, "Syphilis and Tabes Dorsalis," from 3400 cases of syphilis found 290 with syphilis of the nervous system. Engelstedt and Gerhardt have come to the same conclusions.

**Historical.**—The history of syphilis of the nervous system began shortly after the first great epidemic of syphilis at the end of the fifteenth century. It was a well-known fact that the disease could affect the internal organs and that paralysis might result from it. However, John Hunter, in 1790, taught, with the entire weight of his authority, that the internal organs were never affected by the disease. Ulrich von Hutten recognized that paralysis occurred in some cases among syphilitics, but he attributed this to the use of mercury.

As disease of the bones of the cranium not infrequently occurred, it was natural that this was often ascribed as the cause of the paralysis and other symptoms of the brain irritation. Lallemand first, in 1834, demonstrated conclusively that syphilitic disease of the meninges and brain substance did occur. The studies of Griesinger, Esmarch, C. Westphal, Gros, Lancereaux, Wagner, and Wunderlich have also contributed greatly to the establishment of the relationship between syphilis and brain affections.

**Gummatous Processes and Heubner's Arteritis.**—Our pres-



ent knowledge of syphilis became possible only after two discoveries with reference to its nature had been made. The first was the description of the gummatous character of specific processes, by Virchow, and the other was the disease of the cerebral arteries due to syphilis, described by Heubner. These two scientists have enriched this particular field as no others have done, because their discoveries first brought clear pathological anatomical conceptions, where before everything was uncertain and chaotic.

**The Symptoms in Themselves Not Characteristic.**—The first clinical observations concerning nervous syphilis appeared to give to their character something of a similarity, a more or less definite symptom complex. However, this view was opposed by many experienced authors. Gowers was one of the first to emphasize the fact that syphilis of the nervous system produced no symptoms or combination of symptoms, which might not be called forth by other causes. We will by the aid of individual clinical pictures often have the opportunity of referring to the correctness of this view. We will be able to observe that tumors of the brain and spinal cord as well as multiple sclerosis can, for a long time, present clinical symptoms which bear a great similarity to specific disease of the nervous system. One may also add that this resemblance extends as well to the pathological examination. This fact is particularly well exemplified in many cases of tubercular disease of the central nervous system, especially since our knowledge concerning tuberculosis of the spinal cord has been extended.

**The Infectious Factor.**—We know that it is not always possible to differentiate macroscopically or microscopically whether we have in the existing case a retrograde changed tubercle or a gummatous nodule, whether an induration is the beginning of a tubercular or syphilitic process. It not infrequently happens that both syphilis and tuberculosis may exist in a state of isolation in an organ, and this is true with regard to the nervous system. Sarcoma of the spinal cord may also present similar symptoms of specific disease. These difficulties have long been recognized, and for this reason the search for the cause of the

infection in syphilis had a practical purpose. The real history of these endeavors had its beginning in 1879. In this year Klebs communicated his experimental results which had been obtained from working with monkeys. His conclusions were:

First. That human syphilis may be communicated by vaccination with newly formed syphilitic tissue to animals. In infected monkeys exactly similar processes occur as in human beings.

Second. In the specific processes of humans are found certain low vegetable organisms, fission fungi, which grow outside of the body, and take on peculiar and characteristic forms, which he calls "Helicomonaden."

Third. Through the transmission of these peculiar forms to suitable animals, changes can be produced which correspond to those occurring in human primary syphilis as well as to those brought about through vaccination in the monkey.

From this time forth work was done to discover the exciting cause of syphilis. The difficulties in the way of obtaining definite results were due chiefly to three things: (1) a lack of familiarity with the numerous non-pathogenic bacteria found in both the male and female genitalia; (2) to the fact that one nowadays cannot experiment on man; and (3) in the animal experiments hitherto the fact opposed that human syphilis was supposed not to be transmissible to animals.

**The Transmission of Syphilis to Monkeys.**—An entirely new era appeared in the investigation on this subject when, Metschnikoff and Roux in Paris, and also A. Neisser, had succeeded in a manner entirely free from objection in transmitting syphilis to monkeys.

Metschnikoff's article, delivered at the International Dermatological Congress in Berlin in 1904, as well as Neisser's communication entitled "My Attempts in the Transmission of Syphilis to Monkeys," acted as an inspiration. Metschnikoff reported out of nine chimpanzees infected with syphilitic virus nine developed syphilis.

**Schaudinn's Spirochæte pallida.**—The much sought for goal



of discovering the exciting cause of syphilis was left to a non-medical man to attain. The zoölogist Schaudinn was the first to see the *Spirochæte pallida* unstained, and in them to recognize the exciting cause of syphilis. Not through a lucky chance, but as a result of his studies concerning spirochæte, he was consistently brought to his epoch-making discovery.

His first communication concerning the spirochæte he published together with Hoffman in 1905. These two scientists reported that they had found true spirochæte, not only superficially in primary lesions and papules, but also, which is of especial interest, deep in the substance of these lesions. The first confirmation of this discovery came a week later through E. Paschin, of Hamburg, who stained old preparations from three primary lesions with Giemsa's solution and was able to demonstrate the spirochæte in all of them.

At the present time the spirochætes have been found in secretions from the primary lesion as well as in all secondary lesions, in the lymph-glands, in all the internal organs, in the blood-vessels, in the blood itself, and particularly numerous in syphilitic fœtuses.

What concerns our special theme is that previous to 1910 \* the spirochæte had only been found in the brain and spinal cord in syphilitic fœtuses. Ranke exhibited at Baden Baden at a meeting of the Southwestern German Neurologists preparations of the pia mater and the blood-vessels of the brain cortex taken from a child with hereditary syphilis in which the spirochætes were to be seen. Strassmann in 1910 reported a case of a cerebral gummatous tumor in which he found the *Spirochæte pallida*.

**Proof of Specific Infection and Its Difficulties.**—Personal confirmation of the specific infection still remains important for the diagnosis. The personal proof of a past syphilis

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\* Since 1910 the spirochæte has been demonstrated in other tissues of the central nervous system and in the spinal fluid in cases of nervous syphilis. Just recently Noguchi has found the spirochæte in forty-eight brains out of two hundred examined in cases of general paresis and in the spinal cord in one case out of twelve examined in tabes, deeply embedded in the nervous tissue. (*Journal of Experimental Science*, Feb. 1, 1913; *Münchener med. Wochenschrift*, Apr. 8, 1913.)

has often to battle with the greatest difficulties. We must consider first that many persons against their better knowledge will deny a past infection, and, second, a number of persons unfortunately do not know that at some earlier period they have received an infection.

The securing of an admission of a previous infection depends very much upon the manner in which the physician approaches his patient and the persistence of his questioning. The conscious denial of an earlier infection from a patient who thoroughly understands the importance of a truthful answer, according to my experience, seldom occurs. There is no social position, no age in which one can exclude the possibility of a previous infection. One must think of the possibility of an extramatrimonial infection, which is as apt to occur among the higher classes as among the lower, and which is not infrequently denied.

**Ignorance of the Infection.**—With regard to those who are absolutely unaware of ever having had an infection, Fournier says that in 50 per cent. of his cases in women he found this to be true. He speaks of the frequency of “syphilis insontium.” Fleiner some years ago reported a series of cases of severe tertiary lues in patients who had no knowledge of either the primary infection or of ever having had any secondary symptoms. Hirschl has reported from Lang’s clinic in Vienna 63 cases of late forms in syphilis, in which there was absolute knowledge of a previous infection in the personal history of 54 per cent. of the cases, in 9.5 per cent. a probable knowledge, and in 36.5 per cent. of the cases there was in the personal history no evidence whatever.

**Extragenital Infection.**—It happens quite often with those infected extragenitally that they have no knowledge of the infection, particularly where the infection does not occur in a prominent situation, as the lip or face, but on the mammæ, or, for example, the fingers. Hahn, out of the large clinical material of Engel-Reimers at Hamburg at his disposal, estimated the frequency of extragenital infection in Germany, France, and Denmark as varying between 4.5 per cent. and 5.5 per cent. Von Beloussow states that in

Russia the number of genitally infected is only from 22 to 26 per cent. of the total number of infections.

I am able to report some cases out of my own experience illustrative of extragenital infection.

**CASE ONE.**—A coachman whom I treated for *tabes dorsalis* had, when a boy thirteen years old, slept for many consecutive nights in the same bed with a farm hand. Two months later he was treated in the hospital at Bützow for a syphilitic eruption on the buttocks.

**CASE TWO.**—A strong, healthy woman came to me with symptoms of a beginning aneurism of the aorta. After a thorough examination the following history was obtained: Before her first marriage she was engaged, and from her betrothed was infected on the lip, subsequently undergoing an inunction cure.

Cases of extragenital infection at an early age in patients with *tabes* and general paralysis are also reported by Krön, von Rad, Halban, Kutner and others. Bradshaw's case might be related here.

A man 40 years old, with *tabes*, had acquired his syphilis 18 years before. At that time he suffered with chapped hands, and had as a room-mate a man who had a syphilitic ulcer on the back of one of his hands.

**Syphilitic Findings Postmortem with Negative History.**—In my department at the Eppendorf Hospital during 1897 and 1898 every new patient received was questioned carefully for a history of syphilis, and their bodies subjected to a painstaking examination for evidences of a previous lues. In a number of cases, in which the history and examination were negative, postmortem visceral syphilis was found.

A review of the literature of cases of nervous syphilis teaches us that many cases of a specific nature are found where the history of an infection is wholly lacking. One could report almost indefinitely observations of this character. Such examinations warn us that we must be very careful of the use we employ of a denial with reference to a specific infection.

One should also use every means in cases of doubtful

diagnosis, where previous syphilis is admitted, to assure themselves of the correctness of the admission. The laity are sometimes inclined to regard every infection of the genitalia, such as gonorrhœa, soft chancre and even herpes, as specific in nature. Dualism of the soft and hard chancre, since the discovery of the *Spirochæte pallida*, seems to be established beyond any doubt. On the other hand, one must remember that in certain rare cases the specific primary lesion may constitute the only evidence of syphilitic infection, no other symptoms appearing.

**Examination for Past Evidence of Syphilis.**—If one has had the opportunity of being stationed for some time in the women's department of a large syphilitic clinic, one will soon recognize how unobtrusive, hidden and apparently harmless an affection the primary lesion often is. The "érosion chancreuse," a little elevation, an insignificant induration, is all there is to be seen. The glandular swelling in the groin in women who do no manual work may be very slight, and can be entirely lacking. The secondary symptoms also may be so little manifest that the physician must make a thorough search in order to discover them. One can easily understand how women so often, even with the best intentions, are unable to give any positive information.

Very often a careful examination of the entire body will disclose evidences of a previous infection. The more thoroughly this examination is performed, the greater one's experience with the superficial manifestations of syphilis on the skin, the mucous membrane and bones, the sooner one will be able to form a positive opinion. Pay particular attention to the pigment-syphilide, that is, the residual in the skin and mucous membrane from specific efflorescence, also alopecia and leucoderma, especially the latter, which one, in spite of the fact that Lewin has demonstrated that it may occur in non-lueticæ, should regard as a most important indication of a past syphilis. Palmer in 600 cases found it present in 70 per cent.

Give heed to chlorosis, the lattice-like disruption of the tonsils, the presence of struma, the significance of which as



symptoms of earlier syphilis Engel-Reimers, of Hamburg, has especially pointed out. The reproach that every scar and pigmented spot is often regarded as evidence of a past syphilis is not valid when applied to the intelligent and honest observer.

There is always, however, an inconsiderable number of cases, even during the infectious period, which after the most painstaking examination present no evidence of lues.

Palmer, under the direction of Engel-Reimers, demonstrated in 600 women whom I had treated during the initial lesion, and some of them during the secondary symptoms also, that a few months later the most careful physical examination failed to disclose the slightest stigma of syphilis. In such cases possibly Wassermann's serum reaction will aid in the diagnosis. In a later chapter we will see that the Wassermann reaction occurs frequently, although by no means regularly, in those who either have or have had syphilis. In the proper estimation of the results of the serum reaction great caution is necessary. This subject, however, will be discussed in another chapter.

I wish to emphasize particularly that a large number of healthy children is no contradiction of a past lues in the parents. I have repeatedly encountered this idea even among experienced physicians.

**Not Every Organic Nervous Disease in a Person Infected with Syphilis is of Specific Origin.—CASE THREE.**—For example: A man thirty-eight years old acquired syphilis from a razor cut on the chin. Two years later he presented himself to me with severe radiating pains and a spastic paraplegia of the lower extremities first, and then later the upper extremities, for which there appeared to be no other attributable cause. Under an energetic antispecific treatment, with pauses, the severe disturbance of the spinal cord disappeared in the course of a year and a half. Four years later the patient, in whom during the two years previous to his death tubercular disease of the vertebræ had developed with multiple burrowing abscesses, died with a general marasmus. At the postmortem it was ascertained that in addition to a fresh caries of the vertebræ there were scars

of an old tubercular process in the cervical and lower dorsal regions where the spinal cord had been compressed in two places. There was no other evidence of either tuberculosis or syphilis in the body.

**There May Also be a Combination of Several Etiological Factors.**—Along with a proven syphilis there may exist a chronic alcoholism, a head injury or an acute infectious disease, which may, either directly or indirectly, affect the nervous system.

One must not neglect in their etiological reflections alcohol. We know since Bourdon's work in 1862 that the pseudotabes alcoholica may sometimes very closely resemble disease of the spinal cord, that alcohol in the etiology of progressive paralysis, as well as of epilepsy, together with syphilis, plays an important part. Because of the frequent combination of syphilis and alcoholism we often do not know in an apoplexy which factor to ascribe the brain hemorrhage to.

If a patient with the history of an earlier syphilis has reached an age where arteriosclerosis may be expected to exist, the assumption of a relationship between the former lues and the apoplexy loses greatly in probability.

Moreover chronic alcoholism has an especial importance since it weakens the nervous system, and in those persons who have been subjected to the toxin of lues makes it more easily susceptible to disease. Oppenheim states that excesses in *Bacco* in non-alcoholics may give the impulse for the beginning of brain syphilis.

It has long been recognized that an injury to the head in luetics can be the cause of an outbreak of brain syphilis. Especially has this been observed in the development of brain gummata. Henneberg mentions a case anatomically proven of meningitis basalisluetica in a previously entirely healthy man produced by a severe fall on the head.

**The Diagnostic Importance of Antispecific Therapy.**—The assumption of the specific nature of a nervous disease because it disappears under antispecific treatment is in the main valid, but there may be exceptions, as the case cited with tuberculosis of the vertebræ and compression of the



spinal cord, which apparently receded under the antispecific treatment, shows.

On the other hand, as Fournier, Lancereaux, Heubner, and Rumpf have especially called attention to, there are specific gummatous processes which not infrequently are refractory to mercury and potassium iodid. Gowers and Horsley have stated, basing their position on pathological-anatomical examinations, that brain gummata are not curable by mercury and iodid, and recommend trepanation as the indicated therapy.

In two cases of gummatous character in the brain, in each one of which the attending physician had excluded syphilis because mercury and iodid had not benefited, and also in my department at Eppendorf, had shown themselves to be completely refractory to antispecific treatment, I made the postmortem. In both cases I was able to demonstrate microscopically the gummatous nature of the brain changes.

In many cases of syphilis of the nervous system under the influence of the syphilis, certain changes are produced in the arteries which create disturbances in the nutrition of the part supplied by the arteries and lead to necroses. Such necroses are not in themselves specific and one should not expect to influence them by antispecific therapy. One should also consider that in so far as the function itself is concerned at the time, the result is the same whether the functionating nervous element is compressed by newly formed syphilitic tissue or, as a result of the treatment, by actual scar tissue.

Keeping this in mind one can easily understand why there is only a limited number of early cases in which from treatment we may expect a full recovery. My experience has been that physicians usually are too optimistic in their prognosis of organic nervous affections recognized as syphilitic. A review of the literature pertaining to this subject is also open to the same criticism. Too great an influence is attributed to the therapeutical factor.

**Summary.**—*First.* Disease of the nervous system due to syphilis is not infrequent. It is also probable that its frequency is on the increase.

*Second.* Since every clinical manifestation of nervous syphilis may be caused by non-specific processes it is extremely important, where possible, to obtain a history of syphilis in the patient.

*Third.* When the infection has once been determined, that does not prove that the present existing nervous disease is of a specific nature.

*Fourth.* If the symptoms of the existing case are such as specific disease may present, then the probability of a relationship increases, particularly if other signs of syphilis are present in the patient.

*Fifth.* The etiological value of a proven syphilis not infrequently experiences more or less of limitation because of a combination of causative factors.

*Sixth.* Success or non-success of antisyphilitic therapy is only conditionally to be regarded as a means of differential diagnosis.

*Seventh.* An important addition to our means of determining as to whether an organic nervous disease is of a syphilitic nature is found in the application of the four reactions for the examination of the blood and spinal fluid.

## II

### PATHOLOGY

THE pathological anatomy of specific disease of the nervous system is deserving of thorough study. Only in this way are we able to recognize on the one hand that the clinical symptoms can and must be manifold, and on the other that a certain group of symptoms appear with especial frequency. The study of nervous syphilis obtained its incentive first from the pathology. That the pathology has been somewhat backward is due to the fact that because of a more efficient therapy fewer cases of nervous syphilis have come to post-mortem than of other organic nervous diseases.

I can find in a review of the postmortem cases at the Eppendorf Hospital, 1890-1899, only 24 in which specific disease of the nervous system was demonstrated.

**Cranium and Vertebrae.**—In relation to specific disease of the bone we are interested here only in so far as it concerns the bones of the cranium and spinal vertebrae. Syphilis manifests itself in bones as periostitis, ostitis and as gummatous formations. Periostitis occurs rarely in the secondary stage and then only in a moderate degree. It occurs oftener in the tertiary stage, and results frequently in this stage in a wide-spread and diffuse hyperostosis.

Along with and following a periostitis an ostitis often develops which leads to the deposit of a newly formed bony substance in the medullary canals, to an eburneating osteomyelitis. The exostoses are, excepting the tibia, most frequently located on the cranium. The specific ostitis, besides causing hyperostosis, may lead to osteoporosis and rarefaction (dry caries, according to Virchow). Necrosis also occurs, due to eburnization with secondary blocking of the Haversian canals. In this way there occur more or less extensive defects in the bones, and the classical spot for these to come is on the bones of the skull. Indeed this juxtaposition of bony defects and hyperostoses, which permanently

remains even after the gummatous tissue has been transformed into connective tissue, is characteristic of syphilis of the bones and especially of the bones of the cranium.

Syphilis of the bones leads also to a true gummatous formation which is tumor-like in character.

In regard to the frequency of syphilis of the skull I can find only one reference. Mildner, in 1872, stated that in seventeen cases of syphilis of the bones, the bones of the cranium were affected eight times. The disease occurs most often in the frontal bone, along the supra-orbital prominence; then, in point of frequency, comes the parietal bone. Disease of the bones in hereditary lues is of the same character as in the acquired form, except that the hyperostosis is usually not so firm in the hereditary type (Stroebe).

It is clear that disease of the bones may affect the brain and spinal cord and their membranes, either through pressure or by an extension of the inflammatory process to the nerve tissue. But one must not consider, even in extensive disease of the cranium, that affection of the brain is the rule. On the contrary, one sees surprisingly often, even where the brain is laid bare, that it escapes involvement.

**Syphilis of the Vertebræ.**—Specific disease of the spinal column is rare. When it occurs the cervical part seems to be the most often affected. In contrast to tuberculosis, which most frequently involves the dorsal region, syphilis affects the spinous and transverse processes instead of the bodies of the vertebræ.

There are observations which demonstrate the possibility of severe late specific ulceration of the posterior wall of the pharynx affecting the upper cervical vertebræ by extension. In the vertebræ so attacked there comes a periostitis and osteitis and consequent necrosis of the bone. In this manner the necrosis of the entire body of a cervical vertebra originated, as well as the casting off of the necrotic and sequestered anterior arch of the atlas in the cases of Autenrieth and Fisher. Gerhardt mentions in his monograph concerning syphilis of the spinal cord that the spinal vertebræ may become affected by an extension of the disease from the cranial bones. In the diagnosis of a specific



lesion of the vertebræ one should consider whether tubercular disease has not overtaken a luetic patient. The following observation in my own experience will illustrate this:

CASE FOUR.—A strong, healthy man became infected with syphilis. Two years later he developed symptoms of cervical caries with secondary paraplegia inferior and superior, which in the course of a year, under energetic anti-specific treatment, disappeared; then he developed tuberculosis of the lungs and died. The section proved the case to have been one of tubercular caries which had healed.

The extension of specific disease of the vertebræ to the spinal cord and its coverings occurs far less often than an involvement of the brain from disease of the skull.

**The Pathology of Nervous Syphilis.**—The pathological changes which occur in nervous syphilis may be classified under four heads. The first is the syphilitic new growth; the second, the chronic hyperplastic inflammation; the third, the disease of the blood-vessels. The consequences produced by specific disease of the blood-vessels are not to be regarded as syphilitic in character, they are merely the result which must occur wherever the nutrition to any part is hindered or shut off completely. The necrosis of nerve tissue so often found in the brain of syphilitics is only secondary in nature. Under the fourth classification comes primary parenchymatous degeneration. Formerly only a causative relationship with syphilis was attributed to this type of degeneration. It was referred to under the names of post- or metasymphilitic disease. This classification had for a long time been regarded as unsatisfactory by many (Erb, Hirschl, Raymond, Leredde), and the discovery that in the two chief types of the so-called parasymphilis the same *Spirochæte pallida* was to be found as in the various forms of cerebrospinal syphilis rendered the old nomenclature obsolete. Head and Mott have suggested calling what was formerly considered as parasymphilis, parenchymatous syphilis, and the cerebrospinal syphilis, syphilis of the mesodermal tissue. Still more recently Sormani has proposed dividing syphilis of the nervous system into the following classifications: 1. Lues vasculorum cerebrospinalis. This

comprises what was formerly considered as the "true" cerebrospinal syphilis. 2. *Lues parenchymatosa cerebrospinalis*; which includes what was formerly regarded as meta- or parasymphilis. It may be said in the beginning that one seldom finds any one of the four classifications alone in any case, but usually in combination. The division of specific disease into primary, secondary and tertiary stages is an old one. At the present time, since the spirochaetes are found in all three stages and the Wassermann reaction may also be present, correctly speaking this division cannot be maintained. For practical reasons, however, the old division would seem worth retaining.



FIG. 1.—Cut from the left paracentral lobe (personal observation). Under the raised dura, *b*, a gummatous tumor, *a*, which extends as a diffuse infiltration to part of the brain cortex, *c*.

**Gummata.**—These appear as smaller or larger, single or multiple growths, or diffuse and extensive infiltration.

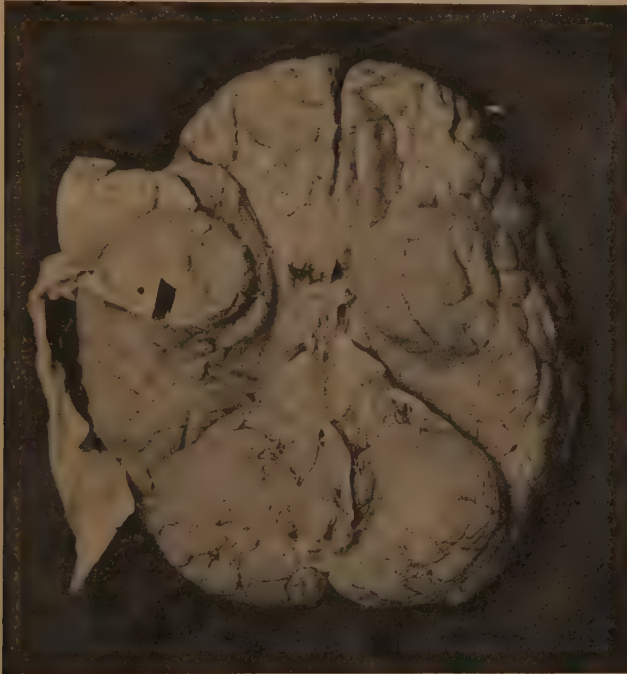
Statistics concerning the frequency of gummata have only a relative value, because many gummata are healed, and therefore a pathological diagnosis is impossible. Also, because of their varied distribution, often clinically they escape recognition. Our large material for section at Eppendorf (about 2400 cases yearly) shows that the majority of cases of gummatous syphilis of the liver are diagnosed nephritis chronica or amyloid degeneration. There are, however, some statistics on this subject.

Fournier found in 4000 cases of late syphilis, gummata



in 6.3 per cent., Grön in 3471 cases, 11.1 per cent., and again in 36,757 specific cases gummata in 11.8 per cent. of the cases. According to Grön, the arteries are the most favored location for gummata, of the internal organs the kidneys and liver, and then next in frequency comes the brain.

Gummata vary in size from a hempseed to a walnut. However, many larger ones have been described.



**FIG. 2a.**—A hard, fibrous gumma on the base of the right frontal lobe, growing out from the dura. (Personal observation.)

Thus Bruns reports a case in which a gumma involved the white substance of the left occipital lobe, the left upper parietal lobe, the left gyrus marginalis and angularis and the posterior end of the first two left temporal convolutions. Its color is usually a grayish red in fresh specimens. It may also take on a yellowish tinge. Very often it undergoes regressive changes and it then appears yellow. The consistence of the fresh, not yet metamorphosed, tumor is tough and hard; most often it gives a rubber-like sensation to the palpating finger, which fact has contributed some-

what to its name. Through regressive changes gummata may become soft, although usually only partially so. More often they become hard through transformation into a cheesy mass. By mixed infection there may be pus formation.

The favorite location is the dura, on the convexity as well as the base. At the base of the brain, gummata occur



FIG. 2b.—Gummata on the inner surface of the dura in the right cranial convexity.

particularly often as small tumors, with preference for the neighborhood of the arterial trunks. In the substance of the brain, gummata appear in the cortex and most often in the region of the central convolutions. In this location not infrequently they are found infiltrating the brain substance so uniformly that the contour of the cortex is scarcely changed; only its consistence becomes firm and hard. They are sometimes in direct contiguity with the meninges, and when found in the interior of the brain, which is not infrequent, in proximity to the large ganglia.

A man with a specific infection developed symptoms of a tumor in the left internal capsule. The postmortem revealed a gummatous growth situated in the left optic thalamus and lenticular nucleus. In the brain substance surrounding these ganglia secondary changes were also found.

In a case published by me four years ago in which there was a combination of tabes dorsalis, arteriosclerotic encephalomalacia and gummi cerebri, the gummatous growths were located in the right lenticular nucleus and the internal capsule, extending below to the optic tract and above to the nucleus caudatus.

In this case the Wassermann in the blood was strongly positive, in the spinal fluid negative with 0.4 c.c. of fluid and strongly positive with 1 c.c.



FIG. 3a.—Gumma of the dura (personal observation).



FIG. 3b.—Gumma of the dura (personal observation).

Gummata have been found in the brain in the frontal, parietal, temporal, and occipital lobes and in the fourth ven-

tricle. They also occur in the cerebellum, pons, and medulla. Gummatous nodules can develop in the hypophysis. How numerous they may be, a cut taken from Baumgarten will illustrate.

A beautiful case of gummata in the optic tract and pons is reproduced from Cornil (Fig. 5).

A large pontine tumor of gummatous origin is represented in a case of Lang's (Fig. 6).



FIG. 4.—Multiple gummata on the base of the brain (Baumgarten, Virchow's Archives, vol. 86).

As a further example of gummatous growth on the base of the brain a case of Siemerling is cited. Observe in this specimen the involvement of one pyramidal tract and the interpeduncular space (Fig. 7).

That in a diffuse disease of the brain, such as general paralysis, disseminated miliary gummatous nodules do occur, has been shown by Sträussler. The following cut taken from Sträussler's work represents the appearance of the smallest gummata under the low and high powers of the microscope (Figs. 8 and 9).



In Fig. 10 are shown by microphotograph brain gummata under the low power. One can observe in the centre the necrotic caseated tissue, on the periphery of the same an inflammatory zone, within this zone also numerous blood-vessels with thickened walls.

Fig. 11 shows how the



FIG. 5.—Gummata of the optic tract and pons.

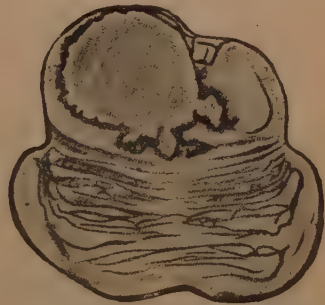


FIG. 6.—Syphilis of the central nervous system (Traité de Médecine 2<sup>éd.</sup> Tome IX.)



FIG. 7.—Gummatous changes on the base of the brain. Vertical section through the mid-brain in the region of the posterior commissure. *Th. opt.*, optic thalamus; *R. N.*, red nucleus; *K. III.*, nucleus of the oculomotorius; *Comm. p.*, posterior commissure; *Ag. S.*, aqueduct of Sylvius; *Py.*, pyramidal tract, on the left almost entirely occupied by the gummatous growth; *T.*, gummatous tumor; *S. N.*, substantia nigra; *Oc.*, outgoing oculomotor fibres; *G. W.*, gummatous growth in interpeduncular space; *Tr. d.*, right tract. (Siemerling, Westphal's Archives, vol. x.)



occurrence of fully sclerosed blood-vessels may indicate syphilis (low power). The elastic ring is all that remains to reveal the presence of vessel lumina.

The surface of gummatous tumors is rarely smooth.

They are mostly uneven and nodular. They are seldom detached from their surroundings, but usually bound down by inflammatory adhesions to the meninges or blood-vessels. There is nearly always an accompanying local meningitis.

By transverse section of gummi in typical cases, one observes a centrally situated yellow, opaque homogeneous dense mass, around which is a grayish semi-transparent tissue, sometimes dense, sometimes

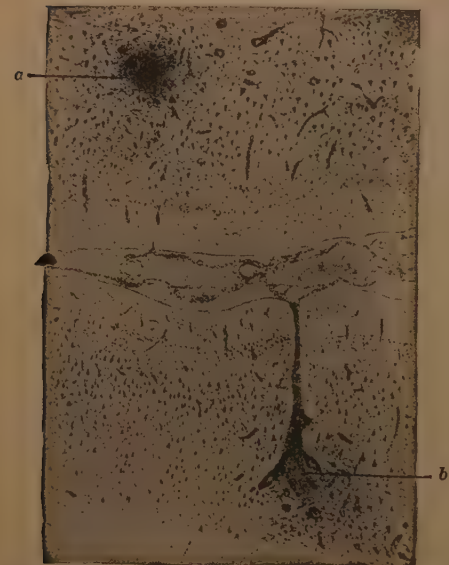


FIG. 8.—Sträussler, encephalitis gummosa. a, b, miliary gummata.

soft in consistence. This is again surrounded, in recent cases, by a soft reddish tissue, in old cases by a dense, dry, often brownish substance.

The microscopical examination shows the character of Virchow's granulation growth. Scattered through the periphery one sees granulation cells, also spindle- and star-shaped cells in the connective tissue and cellular elements which are undergoing a fatty degeneration.

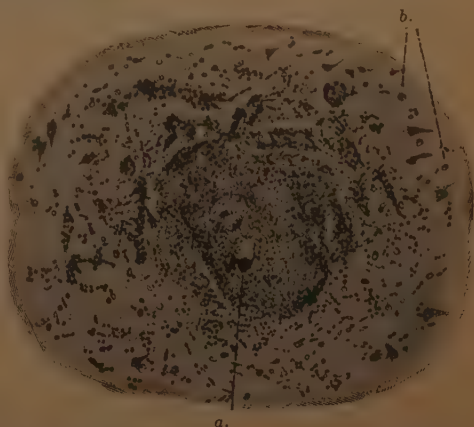


FIG. 9.—Encephalitis gummosa. Miliary gummata with giant cells (a).

In the centre itself there is usually only a necrotic cheesy mass, in which the cells can no longer be differentiated. One sees only a homogeneous opaque mass. Here and there one sometimes finds, in this part, giant cells and epithelioid cells, which cannot be distinguished from the giant cells so commonly found in tuberculosis.

Giant cells were first found in gummatous nodules by Jacobson, then by Baumgarten in gummata of the testicles and liver, and later by the same scientist in gummatous



FIG. 10.—Gummatous encephalitis. (Personal observation) (microscopical examination.)

nodules of the dura mater and the adventitia of the brain arteries. Baumgarten then declared that giant cells and gummatous nodules together indicated a mixed infection of syphilis and tuberculosis. The general opinion at the present time is, however, that true giant cells exist in syphilis without the presence of tuberculosis.

Frequently the caseation does not lie in the centre or near the centre. The fatty degeneration may also be at the

centre or on the periphery. Calcification does not occur in gummata, which is in sharp contrast to atheromatous processes.

**Regressive Metamorphosis.**—In the region regressively changed we find either no vessels, or vessels almost entirely destroyed. In the periphery the numerous vessels all appear diseased with their secondary disturbances of nutrition, which is the cause of the regressive metamorphosis of the newly-formed tissue.

Besides the fatty and cheesy metamorphosis gummatous nodules may also be changed into dense connective tissue, either of part of the nodule, or in its entirety. This takes place especially under the influence of antispecific therapy. We speak then of the cicatrization of the gummatous process. The *Spirochæte pallida* of Schaudinn is only rarely found in gummata.

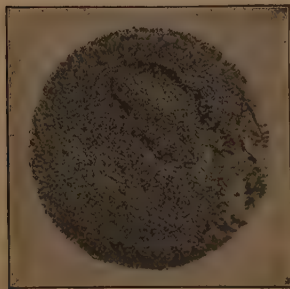


FIG. 11.—Encephalitis gummosa.  
(Personal observation.)

Gummatous tumors begin their growth in the connective tissue, both in the meninges and blood-vessels; with the nerve-tissue itself they have no relationship, except that it

is secondarily affected by their presence.

**Secondary Changes in the Brain Substance.**—By examination with the microscope one can see that from the place where the gummatous changes occur in the meninges the extension is directly into the brain substance. The epicerebral space which normally exists between the pia and the cortex has disappeared. The five layers of Meynert on the cortex cannot be recognized any longer. The cells either cannot be distinguished any more, or there exists an irregular displacement of the individual cell arcades. The blood-vessels are surrounded with a cloak of round cells which not infrequently conceal them. The cell proliferation penetrates into the external and middle coats of the arteries, the perivascular lymph spaces are much dilated and in part also filled with round cells. One sees the nerve tissue itself occupied with round-cell nuclei, and by careful ex-

amination may observe numerous newly formed capillaries and capillary buddings. The ganglion cells are changed in many ways. Besides the above-mentioned disturbances of their arrangement there is more or less variation in their number.

They shrink to an insignificant size, lose their normal figure, their processes disappear, the nucleus is surrounded by only a very thin covering of protoplasm. In the protoplasm one can no longer recognize the Nissl bodies. The nucleus resists destruction the longest, but that also shrinks and finally becomes absorbed. In the tissue one often sees

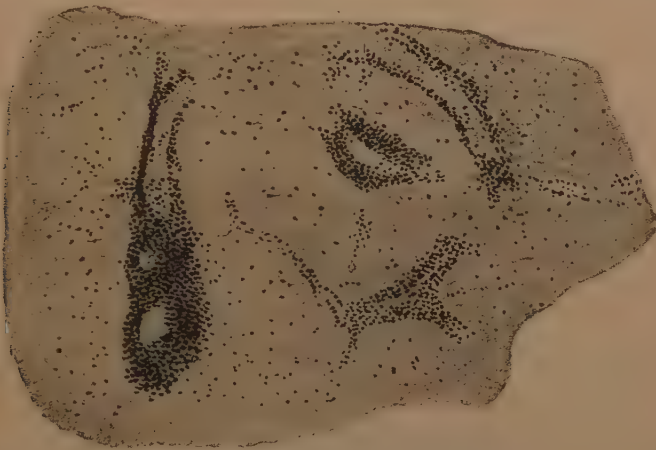


FIG. 12.—Vessels in a brain gumma, surrounded by small-celled infiltration. Hæmatoxylin stain. (Personal observation.)

small and large gaps which originate in part through the reabsorption and disappearance of the ganglion cells, and in part through the occurrence of an edema. The glia-fibres and the star-shaped connective tissue cells appear scattered. The medullated nerve fibres stain poorly with Weigert's stain and appear irregularly, swollen, club-shaped, and thickened.

One sees in other parts a transparent, granular reticulated tissue with round-celled nuclei scattered through it and when this is no longer present, then a simple scar tissue presents itself. In such cases we speak of an encephalitis syphilitica where we find in part sclerosis and atrophy.



The meninges are almost always involved, or, more correctly speaking, we have a meningo-encephalitis to deal with.

**Syphilitic Meningitis, Gummatous and Fibrous Hyperplastic Form.**—Meningitis occurs in all of the three coverings of the brain. In the dura it is connected sometimes, etiologically and locally, with a specific disease of the bone or its periosteum. In those cases in which the meninges are primarily affected we have the gumma, and the gumma appears here, either as a diffuse infiltration or as a miliary sprinkling in the fibrous thickenings and indurations of the membranes. These gummatous infiltrations are not to be differentiated in their anatomical development, their secondary changes, or in their behavior to the neighboring tissue, from the previously described isolated gummatous nodules and the gummatous infiltration occurring in encephalitis.

Meningitis of the gummatous variety is almost without exception combined with a fibrous hyperplastic meningitis. The dura in these cases is often thickened to several times its normal size. It is usually adherent to the arachnoid and pia, with which it presents an inseparable mass. One finds old connective tissue poor in cells and newly formed connective tissue. Between the connective-tissue fasciculi are, irregularly in small foci or as extensive infiltration, small-celled proliferations which always follow the blood-vessels and spring from them. Where the vessels as a result of disease only insufficiently transport the blood or through their displacement and destruction the circulation is shut off, we find caseation and necrobiosis.

**Pia Mater.**—In the great majority of the cases the leptomeninges (especially on the base of the brain) form the starting point of the disease, even where all three meninges are affected. The cases in which the specific processes are limited to the soft meninges are by no means rare. In rare cases the arachnoid alone may be affected.

The leptomeninges are almost without exception adherent, more or less thickened, and with or without gummatous deposit, which may appear as solitary, multiple or diffuse infiltration.





FIG. 13.—Leptomenigitis cerebri luetica. *a*, inflammatory infiltration of the soft membranes; *b*, the walls of the pathologically increased arteries; *c*, gummata. Hæmatoxylin stain. (Personal observation.)

Under the microscope one observes the destruction of the normal configuration of the pia and arachnoid, and the proliferation of the connective tissue, changed by the inflammation and obliterated, with only traces of the elastic fibre-rings recognizable. Indeed in the leptomeninges one seldom ever misses the combination of the simple hyperplastic type of acute and chronic inflammation, together with the processes of new tissue formation, accordingly as recent processes and later stages exist, which in irregular sequence bring clearly before the eyes the chronicity and the ever-recurring relapses characteristic of a syphilitic process. The less the inflammatory congestive element prevails, the greater appears the evidence of the specific neoplastic type of inflammation.

**Simple Meningitis.**—With regard to the occurrence of a simple meningitis in syphilis Virchow has expressed a doubt, and has emphasized the point that in cases of firmly established meningitis simplex the objection may be raised that previously a gummatous process existed which had receded. Heubner and later Buttersack also hold this opinion. Schultze had previously declared it possible that gummatous meningitis had begun the specific process and then receded, leaving only a simple thickening of the meninges, which later at the pathological examination presented nothing specific in character.

Oppenheim is opposed to this view and is inclined to regard meningitis simplex as a not uncommon result of syphilis.

**Localization of the Meningitis.**—The syphilitic meningitis is either distributed uniformly on the base and convexity of the brain or (this is seldom) it is localized. Oppenheim reports a case in which the entire convexity over the frontal and parietal lobes was affected. A case of very extensive leptomeningitis chronica is portrayed by Bechterew (Fig. 14).

Usually the above-described form of meningitis is localized on the base of the brain. In few cases of syphilis of the nervous system does one find the brain base free from pachy and leptomeningitis.

The favorite location on the base is the region of the chiasm and interpeduncular space. The nerves of the eye muscles and the optic nerve are particularly often affected by the specific exudate. The meningeal affection extends also very frequently to the region of the *arteria fossæ sylvii*.

In eighteen autopsies in cases of brain syphilis, from 1892 to 1901, I found meningitis of the base twelve times.

The basilar exudate in specific meningitis resembles the tubercular variety in that it usually involves the whole base. There are, however, exceptions to this. Oppenheim states that sometimes only the optic chiasm or a part of the motor oculi nerve is affected. He reports one case in which the



FIG. 14.—Leptomeningitis chronica with general cloudiness of the soft meninges. (Bechterew.)

gummatous infiltration involved only a small portion of the middle part of the optic chiasm. In other cases reported by him the specific growth involved the trigeminus, the ganglion gasserii, or the individual nuclei of other cranial nerves. I have never had the opportunity of seeing such a case, but one should not forget that an isolated specific meningitis may injure the individual cranial nerves.

**Injury to the Structures on the Base.**—Let us consider the injury done to the nervous formation by syphilitic basilar meningitis. The brain-tissue on the base is affected naturally much in the same way as the changes described as occurring on the brain convexity, but, in addition, we must

consider here the damage which takes place in the large arteries and the cranial nerves. The vessels may become involved through an extension of the specific gummatous or inflammatory processes to their walls or through simple compression.

The nerve-trunks suffer in various ways. The luetic process may encroach on them and then independently

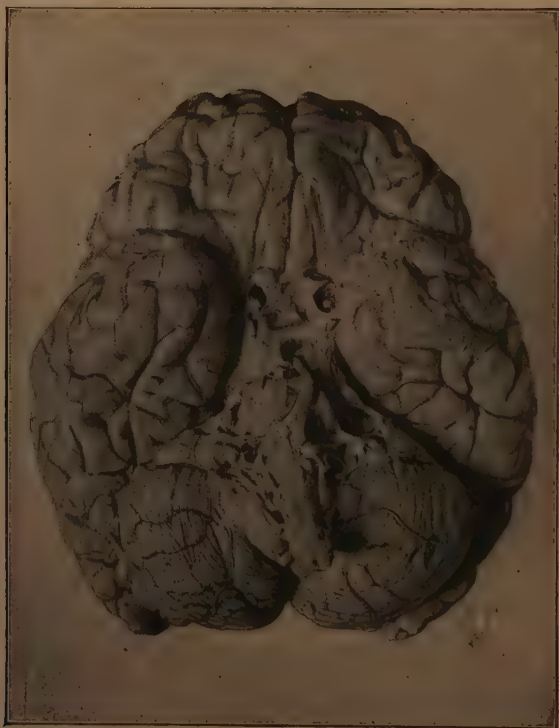


FIG. 15a.—Leptomeningitis basalis chronica. (Personal observation.)

proliferate into the nerve-fibres or by mechanical compression or scar formation injure them. The combination of disease of the membranes together with analogous changes in the nerves themselves is well recognized. Dittrich describes a case of specific amaurosis together with cranial caries of the frontal bone and a thickening of the dura mater with compression and specific disease of the optic nerve.



We will discuss later the question of whether the nerves are primarily affected by syphilis or not; also the question as to whether a specific process existing in the arteries which supply the cranial nerves may involve these nerves directly without the instrumentality of the meninges.

The optic nerves and the nerves supplying the eye muscles are most frequently involved in a specific basilar meningitis, relatively frequently the facial is affected, more seldom the trigeminus and still more seldom the last four cranial nerves, the glosso-pharyngeal, vagus, accessory and hypoglossal.



FIG. 15b.—Meningitis basalis syphilitica. Transverse section from the region of the corpora mammillaria and the oculomotor nerve. Magnifying glass enlargement (Oppenheim). *N. III.*, oculomotor nerve; *Sy.*, syphilitic growth; *C.M.*, corpora mammillaria.

**Disease of the Blood-vessels and Arteries.**—Disease of the blood-vessels of the nervous system is a most important subject. The vessels may be mechanically compressed through meningeal thickening or gummatous tumors, which leads on the one hand to displacement of the lumina of the vessels or on the other to thrombus formation. Steenberg was one of the first to demonstrate that the arteries in themselves, in brain syphilis, frequently may be the seat of pathological changes. He called attention to the frequent thickening of the walls of the brain arteries, the narrowing of their lumina and likewise their displacement. A further advance was made when it was recognized that the vessels also could be the starting point of specific gummatous



growths. Heubner was the first observer to direct universal attention to the study of specific disease of the blood-vessels.

Heubner taught that the infectious agent of syphilis produced primarily an irritation of the endothelium of the blood-vessels of the brain, and that the proliferation of the endothelium was the beginning of the entire process. Only later did this irritation extend to the vasa nutricia and then to a genuine inflammatory process of the adventitial connective tissue. The proliferation of the intima may in the further development of the process remain stationary as such or be transformed into ordinary connective tissue. Caseation, fatty degeneration, and calcification do not take place. The process of the proliferation of the intima leads

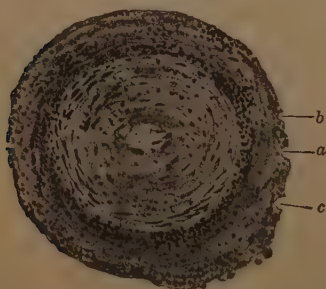


FIG. 16.—Heubner's arterial disease. Infiltration of the adventitia, media, intima. Marked proliferation of the intima *a*, adventitia; *b*, media; *c*, intima. (Personal observation.)

naturally to a narrowing, and in the end obliteration of the vessel lumen. Heubner emphasized the fact that this process may occur in young people. He distinguishes this process, which he calls arteriosyphilis, from arteriosclerosis anatomically by the absence of regressive metamorphosis, the greater tendency of the process to be circumscribed in character, while in

arteriosclerosis it is more general, and finally to the preponderating preference of the latter for development in the large arteries, whereas in arteriosyphilis the medium-sized arteries are the most often affected.

The position represented by Steenberg and Lancereaux that the majority of the clinical symptoms of syphilis are caused by changes in the arteries and their secondary consequences is now accepted as final.

Heubner declared that syphilitic arterial disease was of a characteristic type. The process above described as presented by him was the exact antithesis of the teaching of Virchow and Wagner, which up to this time had been the accepted view. The latter regarded the rapid disintegration of the cells as the chief factor in the specific process,

while the former considered increase in cell activity and proliferation the characteristic element.

In 1872 Cornil and Ranvier demonstrated in wounds,



FIG. 17.—Section of a gumma from the brain-base. Hematoxylin stain. In all the vessels the lumina are much narrowed, at figure *a*, obliterated; in the lumina of the other vessels is some blood *b* (red blood-corpuscles). The narrowing of the lumen is due to the proliferation of the intima *c*. Media and adventitia are hidden by inflammatory infiltrated tissue. (Personal observation.)

ulcers, and other inflammations, that a narrowing and obliteration of the blood-vessels occurred which was similar in character to the obliterating vessel inflammation which

sets in after the application of a ligature, and that the endarteritis syphilitica of Heubner had nothing of a specific nature in itself, although these observers did not deny a special predisposition on the part of luetic individuals to arteritis, and particularly of the brain arteries.

According to Köster the thickening of the intima is closely related and dependent upon areas in the media which have developed from the vasa vasorum. Endarteritis occurs only in arteries which are supplied with the vasa nutricia. For this reason endarteritis is so often found in the brain, because there even very small arteries are pro-

vided with the vasa vasorum, and also for the same reason arteries of a similar calibre in the extremities are spared. The generally accepted opinion at the present time is the one of Cornil and Ranvier that the endarteritis of Heubner has nothing in itself which is characteristic of lues, that the proliferation of the in-

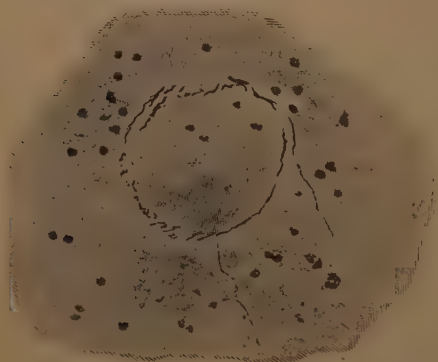


FIG. 18.—The remnants of a vein (phlebosclerosis). One sees in the necrotic tissue still some elastic fibres, arranged in the form of rings. Stain Weigert's elastica method. (Personal observation.)

tima is secondary in nature, and that the inflammatory process proceeds from the vasa vasorum. Strasmann and Beitzke in a recent study of this subject have also concluded that in the vasa vasorum and the perivascular lymph-spaces the starting point of syphilitic vessel disease is to be found.

Ernst Meyer in 1897, after a comprehensive study of this subject, came to the conclusion that the endarteritis of the brain arteries, in so far only as it appears independently and involves a wide distribution, can with a certain definiteness be regarded as specific.

So far as I know the *Spirochate pallida* has been demonstrated only once in a case of endarteritis syphilitica cerebri. This was in a case of Benda's where the specific

nature of the changes could be proven by the small area of necrosis within the cell infiltrate.

**The Veins.**—There is also a voluminous literature concerning the disease of the veins in syphilis. Charcot describes the veins enveloped as in a muff by nuclei. There is a uniform gradually increasing thickening and cell infiltration of the vein walls, finally terminating in an obliteration of the lumen of the vein.

We recognize in chronic disease of the central nervous

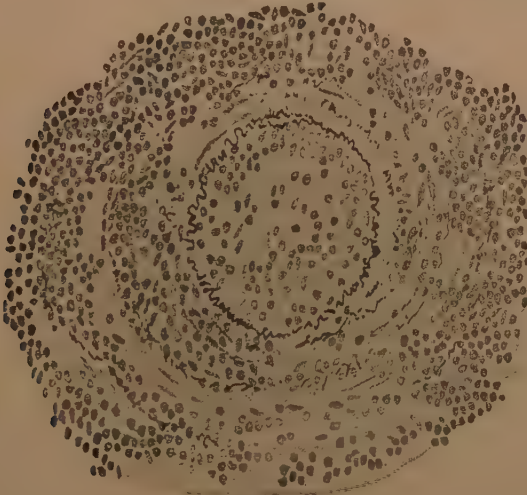


FIG. 19.—Vein from a section from meningitis encephalitis luetica (gummosa). Weigert's elastica stain. The lumen of the vein is obliterated by granulation tissue; the intima and media are destroyed and supplanted by recent connective tissue; in place of the adventitia is only inflammatory tissue. Nothing remains to indicate a former vein except the thickened and broken-up elastica interna and externa. (Personal observation.)

system as different types of vein affections (1) perivascular infiltrations of granulated tissue; (2) peri- and endophlebitis, or simply phlebitis, a disease of all parts of the walls of the vein; (3) the phleboscrosis of Rieder; (4) a true endophlebitis consisting of a large-celled proliferation of the intima or as a fibrous and hyaline thickening of the intima. A very interesting form of endophlebitis proliferans obliterans or tuberosa described by Bartels perhaps also belongs here. Although in the history of the case evidence of syphilis was not obtainable, and although neither clinically nor at the autopsy were signs of syphilis discov-



ered, Bartels, by exclusion and upon the fact of an absolute absence of involvement of the arteries, remembering that Rieder had demonstrated in syphilis that the venous system can be affected long before the arterial, came to the conclusion that syphilis could be assumed as the etiological factor.

**Arteriosclerosis in Syphilitics.**—It is important to further discuss the question of arteriosclerosis and syphilis. It is a well-known fact that very often following a syphilitic infection arteriosclerosis is found in young persons, much younger than the age of forty-five, which one considers as about the time of life for the beginning in the arterial

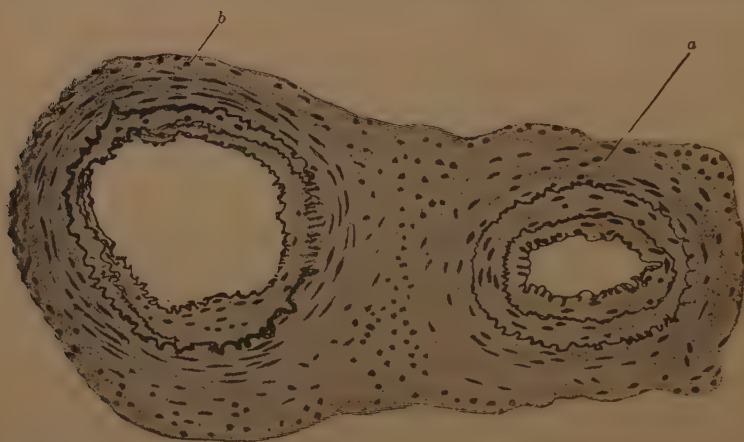


Fig. 20.—Numerous elastic rings in arteries. Stain Weigert's elastica method. (Personal observation.)

system of arteriosclerotic changes. In order to bring this arteriosclerosis into a relationship with a past syphilis, naturally it is important to exclude other causative factors, such as chronic alcoholism, abuses tabaci, severe joint rheumatism, and physical overexertion. The presence of a severe arteriosclerosis in a comparatively young person, if we are able to exclude the above-mentioned factors, justifies us first of all in thinking of syphilis. One should of course not overlook the fact that from time to time cases are observed where one's entire etiological experience fails him. Such cases occur usually where a family predisposition to arteriosclerosis exists. It is to be remembered also that neither the localization nor the extent of the atheroma-



tosis can be utilized with certainty for determining a specific origin. The ordinary arteriosclerosis may be general in character, or localized to a particular region, and may stop short in the large vessels as well as in the medium- and small-sized arteries. The endarteritis of Heubner is likewise often limited to small areas.

I possess preparations from two cases which demonstrate this most clearly. In these cases of two young men,

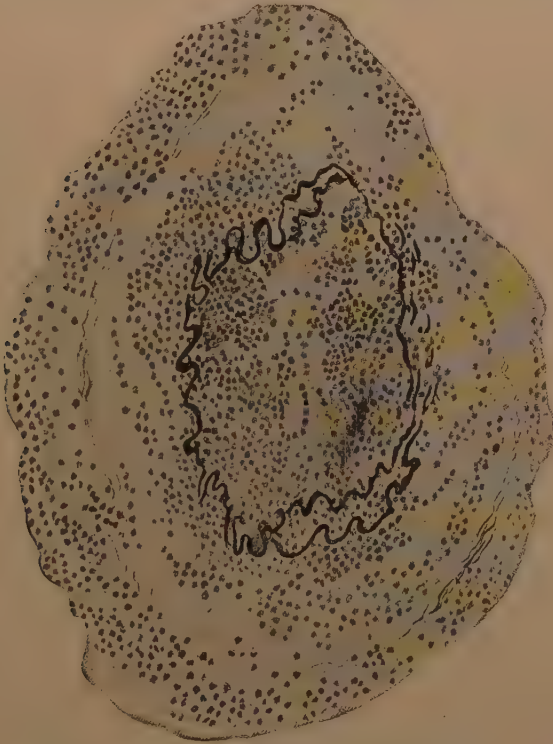


FIG. 21.—Obliterated arteries in a case of specific basilar meningitis. The split elastica is alone preserved. (Personal observation.) Staining by Weigert's elastic method. (Personal observation.)

twenty-four and twenty-eight years of age respectively, the endarteritis was localized in the beginning portion of the *arteria fossæ sylvii*, both cases had a specific hemiplegia, and both died as the result of a severe intercurrent pneumonia which gave the opportunity for the postmortem. The other brain arteries as well as the large arteries of the body were macroscopically normal.

The **Syphilitic Aortitis of Heller-Döhle.**—There has been much discussion recently as to whether there is a clear-cut difference between an atheromatosis of specific origin and one of the usual type. Heller and Döhle have described a somewhat typical picture of a specific aortic sclerosis. Marchand designates the specific aortic changes as “indurated sclerosis.” Heller, Marchand and Heiberg have described the distinguishing specific features as consisting

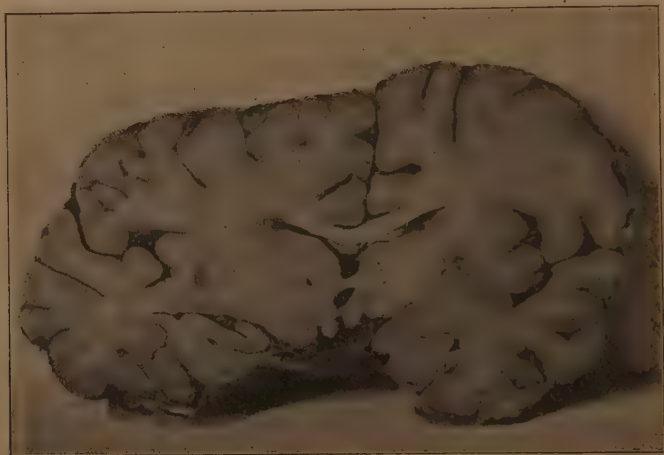


FIG. 22.—Small area of softening in the internal capsule caused by the specific shutting off of the arteria fossæ sylvii. (Personal observation.)

of rugæ with fossæ lying between them. All observers agree, however, that the seat of the syphilitic aortitis lies in the beginning part of the ascending aorta, while on the other hand the common aortitis is chiefly situated in the descending aorta.

Microscopically specific aortitis is differentiated from the non-specific through the primary seat of the changes in the adventitia and media, while in simple aortitis their beginning and preponderance occur in the intima. Reuter, also Schmorl at Dresden and Wright at Boston, have demonstrated the *Spirochæte pallida* in aortas, which showed evidences of the Döhle-Heller type of aortitis. The spirochæte was found in the endothelial proliferations of these aortas. These cases prove at any rate that this variety of aortitis can be of specific origin. E. Fraenkel was the

first to obtain the Wassermann reaction in a case of aortitis as described by Döhle and Heller. Since then this finding has been almost a constant one.

**Aneurism.**—Much more seldom than is the case in the arteriosclerosis of age, aneurism occurs through specific disease of the brain arteries. It is most often to be found in the arteria fossæ sylvii and the arteria basilaris.

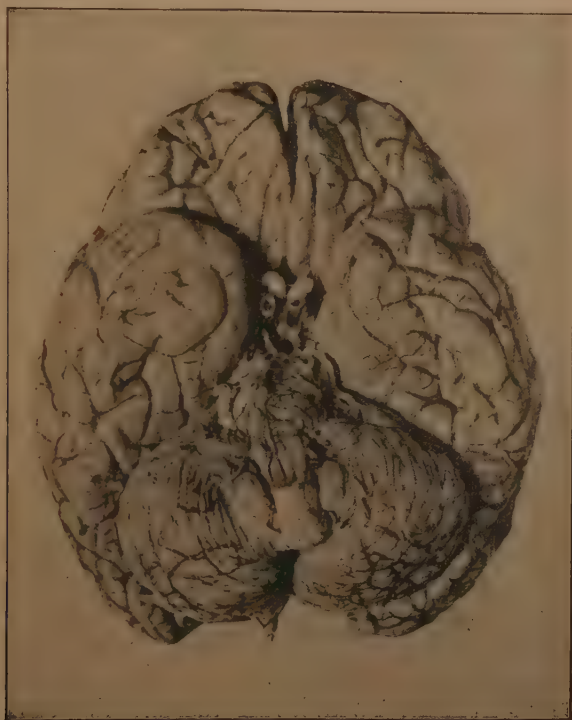


FIG. 23.—Localized arteritis of Heubner. A little toward the left from the middle of the base of the pons one sees the arteria basilaris, which for a short distance is severely affected (Personal observation.)

**Summary of the Vessel Disease in Syphilis.**—If we review the various opinions concerning specific disease of the blood-vessels the following conclusions will become evident:

First. The blood-vessels can become affected by syphilis in a purely mechanical manner both in the meninges and the nerve-tissue itself.

Second. They become involved also by the specific process in the vicinity *per contiguitatem*, that is, the gum-

matous or inflammatory process attacks the arterial walls by extension and may present a peri-, meso-, and pan-arteritis, either with or without true gummatous symptoms.

Third. The vessels may become diseased in another way. An inflammation of the capillaries produced by the toxin of syphilis leads to an inflammatory affection of the walls involving primarily the media and adventitia, secondarily the intima becomes involved, and it may then independently further proliferate. This is the picture of the endarteritis of Heubner with narrowing and obliteration of the lumen and is the form most commonly found. This variety of arteritis may be accompanied by a gummatous infiltration.

Fourth. Syphilis tends to produce an atheromatous degeneration of the arteries, one form of which degeneration cannot be differentiated from the ordinary atheromatous changes; the other, the arteritis of Döhle and Heller, should be regarded as extremely suspicious of syphilis.

**The Results of Disease of the Blood-vessels in Cerebral Lues.**—The above-described changes in the vessels have collectively as their final result the narrowing of the vessel lumen and frequently the complete displacement of the same. Whether through thrombosis or obliteration, the circulation is shut off, and as a consequence of this, severe disturbances of nutrition, sometimes amounting to necrotic softening of the territory belonging to the vessels, are produced. Although the arteries on the convexity as well as on the base of the brain may become diseased, yet the softening in the cortex and the medullary layer underneath, likewise on the base of the brain and the tissue lying immediately above it, occurs much less often than in the interior. The large ganglia, the internal capsule, the pons and medulla may be regarded as the areas of the brain which seem to have a predisposition to softening. In the cortex there exists to a large degree the possibility of the occurrence of a collateral circulation. The areas of softening which are produced by the shutting off the vessel lumen caused by specific disease cannot be differentiated from the softening due to the usual lumen obliteration. We find here



also, through the reabsorption of the broken-down and necrotic tissue and through the productive inflammation of the neurologia, secondary sclerosis and thickening of the affected nervous tissue.

Genuine inflammatory processes in the neighborhood of ischæmic softenings do not occur as a consequence of specific disease of the arteries, but the infiltration of the vessel walls and proliferation of the neurologia cells may be regarded solely as reactive in character.

**Rupture and Secondary Hemorrhages.**—A further result of disease of the arteries is rupture and secondary hemor-



FIG. 24.—Necrosis of the right frontal lobe on the base in a case of endarteritis luetica. (Schaffer.)

rhages. Ruptures occur with and without aneurism formation. Where the elastic tissue is much diminished or entirely destroyed, where the muscularis of the media is supplanted by less resistant connective tissue, the latter without any pouching of the intima may give way to the pressure of the blood and make hemorrhage possible.

It is well to remember that in the examination of preparations containing specifically diseased vessels one seldom encounters aneurism formation, also that the often-occurring thickening of the adventitia and of the tissue adjoining



the vessels is somewhat of a protection against hemorrhage. Hemorrhages in the interior of the brain are not frequent, because the vessels there are not so often affected, nevertheless a vast number of hemorrhages in this region have been observed. Gowers has observed relatively frequent conditions of sclerosis and induration. He believes in such cases the vessel changes do not permit a normal nourishment of the diseased portions, but that the circulation has not been sufficiently impeded to produce an actual necrosis.

**Combination of Different Pathological Forms.**—From a review of the literature pertaining to this subject it is evident that one finds in syphilis very often a combination of the pathological changes which we have been considering. This variety of anatomical change, although not pathognomonic of syphilis, is an important criterion in the diagnosis.

**Differential Diagnosis in Specific Processes.**—The question has often been debated, whether out of the pathological changes alone, without any further information, the specific nature of the disease can be determined. A pathology which is absolutely pathognomonic of syphilis does not exist.

**Sarcoma.**—There are cases of diffuse sarcomatous growth of the meninges of the brain and spinal cord which bear some resemblance to the diffuse gummatous infiltration found in syphilis. There are marks of differentiation, however. We do not find in these cases the almost never-failing signs of a regressive metamorphosis found in syphilis. The spinal cord is only seldom involved, when we exclude the injury done through compression, while in syphilis of the brain and spinal cord we have a meningo-encephalitis or meningomyelitis.

An endarteritis occurs in new growths as well as in specific conditions, but in the former is not found developed to such a great extent nor high degree as in the latter. The marked infiltration of the external membranes and the sheaths of the vessels, as well as the inflammatory infiltrate of the surrounding tissue, is also lacking. A differentiation between these two pathological entities is not very difficult.

**Cysticercus.**—The same is true of the cysticercus-meningitis. We find here also chronic basilar arachnoiditis and

leptomeningitis together with and without a secondary hydrocephalus and an obliterating arteritis. In the majority of cases the diagnosis can be determined macroscopically by the presence of cysticercus vesicles. Stertz reports a case in which he was able to demonstrate the cysticercus vesicles in the spinal fluid by means of lumbar puncture during life.

**Tuberculosis.**—In tuberculosis the condition is different. The gummata may attain the same size as the tubercles. They often appear as miliary in character. The miliary gummata have a predilection for the base of the brain and

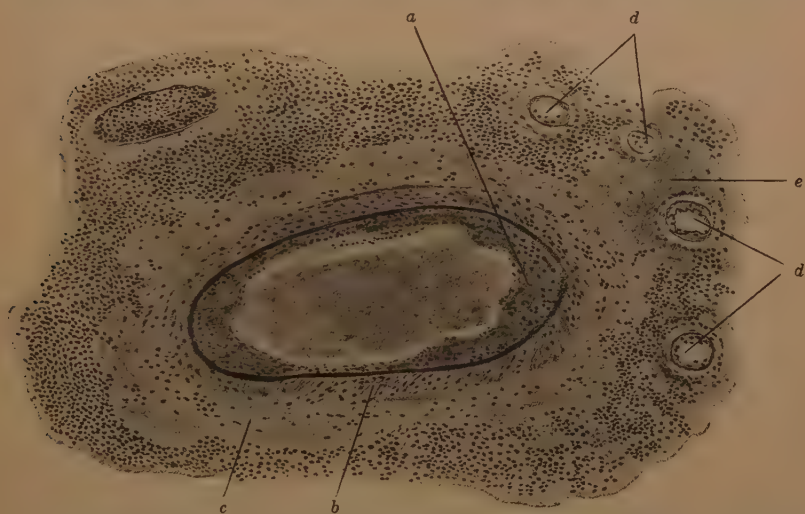


FIG. 25.—Disease of an artery in tubercular leptomeningitis. Weigert's elastic stain. (Personal observation.) *a*, the intima has proliferated and is infiltrated; *b*, media; *c*, adventitia. The artery is closely imbedded in inflammatory tissue. In the arterioles (*d*) the same process is shown. The surrounding tissue (*e*) is in part necrotic.

the course of the large vessels, and they are more often found distributed in the meninges than in the nerve-tissue itself. The caseation in both tuberculosis and syphilitic nodules may be the same. The inflammatory structure of the surrounding tissue may in both forms of growth be present or absent. The microscopical finding does not present any means of distinguishing the nature of the affection, for in gummata giant and epithelioid cells are also found and, as is well known, tubercular bacilli cannot always be demonstrated in tubercular lesions.

Comparing the two forms of meningitis, chronic tubercular as well as the syphilitic type can be diffuse or circumscribed in character. The involvement of the brain substance can in both processes be an extensive one and in both an acute, subacute, or chronic type may exist. In syphilis, as well as tuberculosis, the process develops from the pia septum and the vessels.

The involvement of the arteries in tuberculosis may also be extensive and severe.



FIG. 26.

A glance at Fig. 26, which is taken from a case of tubercular meningo-encephalitis, will show the marked proliferation of the intima, which has brought about a high degree of narrowing. One will also observe here the inflammatory infiltration in the neighborhood of the arteries. Hoche, in a classical case of tuberculosis of the spinal cord, found and described a phlebitis obliterans. Small tubercles microscopically as well as gummata may be observed in the walls of the arteries. Also the outgoing cranial nerves and spinal

cord roots may be either compressed or infected by the meningeal exudate as in a syphilitic process.

For these reasons Rumpf has stated that only in the absence of all other infections, or where specific or tubercular findings are present in other organs of the body (tubercle bacilli not being present), can the pathological diagnosis be determined beyond a doubt.

The following case will illustrate the difficulties in a differential diagnosis:

A laborer as the result of severe epileptic convulsions died in the hospital. The provisional diagnosis of idiopathic epilepsy was made. The postmortem showed entirely normal internal organs. There was no evidence of tuberculosis or syphilis, past or present. On the inner side of the dura over the upper middle portion of the left parietal region there was a tumorous formation which reached, in many places, into the brain cortex and pushed itself wedge-like in between the convolutions. The rest of the brain was normal.

The prosector and a surgeon present, with equal pathological experience to the prosector, were of diverse opinion. The one assumed the nature of the lesion as tubercular, the other as gummatous. The microscopical examination presented the picture of foci of caseation with no giant cells and no tubercular bacilli. On the other hand the vessel changes were so numerous and of so marked a character in the form of obliteration of both arteries and veins, together with so classical a type of Rieder's phlebosclerosis, that the gummatous nature of the lesion could not be doubted.

The general opinion in regard to the pathological diagnosis of syphilis at the present time may be summed up in the following manner. The changes found in the manifold lesions of lues present nothing which may not be demonstrated in simple inflammatory lesions, but the specific lesions in their life history, their localization and occurrence, and finally in their combinations, present characteristics which furnish tangible proofs.

**Primary Disease of the Nervous System.**—Thus far we have seen that the nervous tissue itself has remained primarily



intact, and has only been involved in secondary changes. It has atrophied because pressed upon by gummatous proliferations and meningeal indurations; it has become necrotic because of lumen-obliteration and deficient blood-supply.

Gilbert and Lion have described a form of inflammation in the spinal cord which does not bear the character of the specific granulation tissue and the specific disease of the blood-vessels and have designated this form as "meningo-myelitis diffuse embryonnaire." They have stated in this type that softening of the nervous tissue may be produced by the direct influence of syphilis.

Oppenheim likewise declares that syphilis can cause a simple encephalitis. He bases his opinion upon an old case reported by Charcot and Gombault. In this case there were numerous lesions in the left cerebral peduncle, on the under surface of the pons, and the region of the corpora quadrigemina. The lesions were recognizable macroscopically, and microscopically were shown to consist of a peripheral layer of neuroglia cells and a neutral zone of fatty granular cells. In 1905 Barrett and Danvers, in Massachusetts, described a case of brain syphilis where there existed side by side gummatous changes in the brain tissue, and simple and gummatous meningitis, Heubner's arteritis with the secondary processes of softening and a multiple disseminated encephalitis, which was independent of the disease in the meninges and was able to be distinguished by the genuine inflammatory symptoms around the blood-vessels, the appearance of recent granulation tissue, degenerative changes in the nerve cells, and a secondary reactive proliferation of the glia. Barrett called this process "disseminated syphilitic encephalitis."

Numerous observations of Oppenheim, Siemerling, and Kostentisch indicate that the nerve nuclei are also subject to primary degeneration through the influence of syphilis. The cerebral nerves may likewise present a simple atrophy.

For statistics in regard to the frequency of occurrence of the individual forms of brain syphilis we are indebted to the syphilitic clinic in Vienna. In 29 cases of brain



syphilis there occurred arteritis of the arteria fossæ sylvii 14 times; closure of the right internal carotid, right arteria fossæ sylvii and foramen of Magendie of each one; two cases of cerebral atrophy, hydrocephalus internus two times, encephalomalacia eleven times, thickening and adhesion of the dura with the cranium one time, coincident disease of the skull two times, gummatous processes and circumscribed gummata eight times, encephalitis and leptomeningitis three times, and periencephalitis once.

In a review of 185 cases of syphilis of the nervous system I found 128 cases of cerebral and 29 of spinal lues. From these cases the arterial form appeared 43 times, the meningeal 128, and in 14 cases there was a combination of both forms. In a review made by Patrick in 1901 specific arteritis appeared as the most frequent type, and next in frequency came the syphilitic meningitis.

We may accept at the present time, without the influence of the specific syphilitic changes in the vessel and connective-tissue apparatus of the nervous system, in rare instances that there exists a primary degeneration of the nerve tissue itself in the form of an encephalitis, a softening, an induration and sclerosis, and a simple atrophy of nerve nuclei.

### III

## ETIOLOGY OF NERVOUS LUES AND SPECIFIC ENDARTERITIS

BEFORE we discuss the symptomatology of brain syphilis, it is of importance to consider the etiology of nervous syphilis. Since the statistical presentations on this subject by Rumpf and Naunyn we know that not infrequently within the first year of infection, sometimes indeed within the first few months, syphilis can cause organic disease of the nervous system.

**The Frequency of Nervous Involvement in the Early Stages.**—Naunyn from the consideration of 45 cases of his own, and 209 collected from the literature, came to the conclusion that specific disease of the nervous system appears most frequently in the first year after the infection. According to this authority 48 per cent. of all the specific nervous affections occur inside of the first three years; from this time on their frequency decreases from year to year. This view of Naunyn's has since often been confirmed. Gilles de la Tourette describes an unusually extensive and severe case of syphilis of the brain and spinal-cord membranes which developed two months after the infection. The same author also reports a similar case of Fournier's in which the interval between the infection and the manifestation of nervous syphilis was three months. Two of my cases of brain syphilis developed four months after the infection, and in another case three months after the infection, at the same time that a roseola appeared.

**Late Development.**—Brain syphilis may also appear very late. I have seen gummatous processes develop in the brain after thirty years. Bruns describes a case of a large brain gumma which developed forty years after the infection.

Patrick lays down this tenet: Brain syphilis occurs most frequently during the first year, then in point of frequency comes the second year, and less frequent the third year.

After ten years its occurrence is the exception. In a review of 185 cases taken from my own hospital records and my private practice, in 55 the record was lacking in this particular, in 83 the first symptoms appeared within periods varying from one to ten years, and in 47 cases still later.

One may say in general that brain lues can develop in any stage of syphilis, and also that the tertiary stage is by no means the favorite one.

**Syphilis Acquired Late in Life.**—It has been said that lues acquired late in life predisposes to disease of the nervous system. My own observations in this regard show merely that a number of patients, who contracted syphilis in their fifties and sixties, after a few years became tabetic. On the other hand I can point to many cases in healthy young persons who became victims of severe nerve syphilis.

In 29 cases of brain syphilis autopsied by Neumann their occurrence with reference to age was as follows:

Between 1-18 years of age.....	1 case
20-29 years of age.....	3 cases
30-39 years of age.....	8 cases
40-49 years of age.....	4 cases
50-59 years of age.....	6 cases
60-69 years of age.....	3 cases
70-79 years of age.....	2 cases

My own 185 cases occurred in point of age in the following manner:

Between 1-10 years of age.....	3 cases
10-20 years of age.....	2 cases
20-30 years of age.....	25 cases
30-40 years of age.....	75 cases
40-50 years of age.....	55 cases
50-60 years of age.....	23 cases
60-70 years of age.....	2 cases

Men seem to be more often affected than women, which may be due to the fact that men are more exposed to influences injurious to the nervous system. Among my 185 cases 125 were males and 60 females.

It is doubtless true, as Lochte from material in Engel-Reimer's clinic demonstrated, that syphilis when acquired late in life is apt to run an unusually severe course. Leudet reports two cases in old people, in both of whom, three months after the initial lesion, symptoms of brain syphilis developed.

**Syphilitic Virus with Special Toxicity for the Nervous System.**—The question as to whether different kinds of specific virus exists, and whether a certain form of the toxin might exhibit a special predilection for damaging the nervous system, has been much discussed. One may utilize as an analogy the affinity of lead for the motor tract and ergot for the posterior columns. A certain number of observations incline to raise this question. In the first place the observations of the occurrence of tabes and taboparesis in infantile and juvenile persons are continually increasing whose parents have had syphilis, but in whom no postluetic symptoms were demonstrated.

In a long series of observations the symptoms of nervous disease appeared in the early years of life, but never during the nursing age, and in all the cases other etiological factors, such as alcohol, occupation, worry, physical injuries, and sexual excesses, which have been considered either as predisposing causes or in themselves responsible for the development of these diseases could be absolutely excluded. In all of the cases the specific virus appeared as the only factor.

Second. The observations in regard to the development of the syphilogenetic diseases in married persons have also increased. Many cases of both conjugal tabes and taboparesis have been reported.

Third. The statistics in regard to a combination of tabes and taboparesis with such specific conditions as cerebro-spinal lues, syphilitic spinal paralysis, acute and chronic meningomyelitis syphilitica in married individuals have likewise been augmented. Such cases, for example, where the husband developed general paresis, the wife cerebro-spinal lues; the husband tabes, the wife specific spinal paralysis.

In this group the influence of heredity and social environ-



ment cannot be made use of, since in husband and wife they were different. Their different occupations, the husband in his business, the wife in her household, cannot be seriously considered, since both would naturally lead entirely different lives. Syphilis then must be regarded as the only causative factor in the production of these conjugal affections of the nervous system.

In a case of Mendel's a luetic husband infected his wife. He died of paresis. The wife married again and infected her second husband, and man and wife became tabetic. In a case of my own the patient who had been infected developed tabes six years afterwards, and the person who communicated the infection to him, eight years afterwards became tabetic. These patients had not lived together since the infection of the first one.

Yet more striking is the group of cases which show a tendency for the appearance of tabes, paresis, and taboparesis in families. Numerous cases of this nature have been reported. We also recognize that other syphilogenetic diseases of the nervous system besides tabes and taboparesis may have a tendency to occur in families. Remak reports a mother with lues cerebri, the child with tabes; Nolan, the father brain syphilis, the child paresis; Nonne, the father brain syphilis, the son tabes; Skorzynski, the father brain syphilis, the mother and child paresis. Such observations might be continued indefinitely. All of the cases speak against the assumption of the social environment as a factor, and in favor of the specific toxin itself. Individual cases in the literature also argue against the etiological importance of heredity. The following case is illustrative of this:

A mother before her infection had a child who remained healthy. She acquired syphilis and became tabetic, married a third husband, by whom she had two children, and both of them developed paresis.

There is still another class of cases which etiologically are important. They are those cases in which a number of persons have become infected from the same source, who naturally have an entirely different heredity and social

environment, and yet all, or nearly all, have developed disease of the nervous system. A number of such cases have been reported. I have collected 1902 of these from the literature. The following case will illustrate the nature of them:

Three men, who were friends, one after another had intercourse with a syphilitic puella during the same night. One of the three developed tabes, the other two paresis.

Two merchants acquired lues from the same person. One had later a severe brain syphilis, the other a paraplegia syphilitica spinalis.

My personal opinion formed from a large experience in cases where both husband and wife became either tabetic or paretic is that social environment cannot be considered an important factor, also that heredity and family predisposition may be regarded as not of much influence.

**Objections to the Theory of a Special Toxicity.**—However, objections have been raised to this view. Heubner asks, first, why, if the toxin itself is to be regarded as the chief etiological cause, some members of the same group remain free from involvement? Another question which he propounds is: Can one speak of lues nervosa, when in the same cadaver one finds the degenerations of tabes or paresis along with gummatous brain syphilis? He argues that gummatous disease of the brain and spinal cord does not in any sense indicate a specific nerve poison, since gummata are found everywhere in the various organs of the body. At the same time he refers to those cases in his own experience where one of a married couple became diseased, either with a syphilitic or metasymphilitic affection of the nervous system, and the other one with visceral syphilis.

Since we know that the spinal fluid early shows meningeal changes, that this early infection is a very frequent one, since we further know that in the great majority of these cases the meningeal affection disappears, the question of the cause of lues nervosa becomes clearer. Cases of syphilis of the nervous system are simply those cases of early meningitis which have not fully recovered, cases in which a residuum of meningitis remained, where the spirochaetes continued to live in some of the recesses of the meninges.

**Ehrmann's Theory.**—Recently Ehrmann has reported a case which is perhaps of great importance in this connection. He has, in the pursuit of his studies over the probable path of the specific toxin from the initial lesion in the prepuce, devoted considerable attention to the nerves. He has found in two cases where the prepuce was extensively ulcerated and excoriated, in a large number of nerves of the skin and subcutis, spirochaetes in vast numbers. Ehrmann found the spirochaete not only in the connective tissue accompanying the nerve fasciculus and in the lymph spaces of the nerve

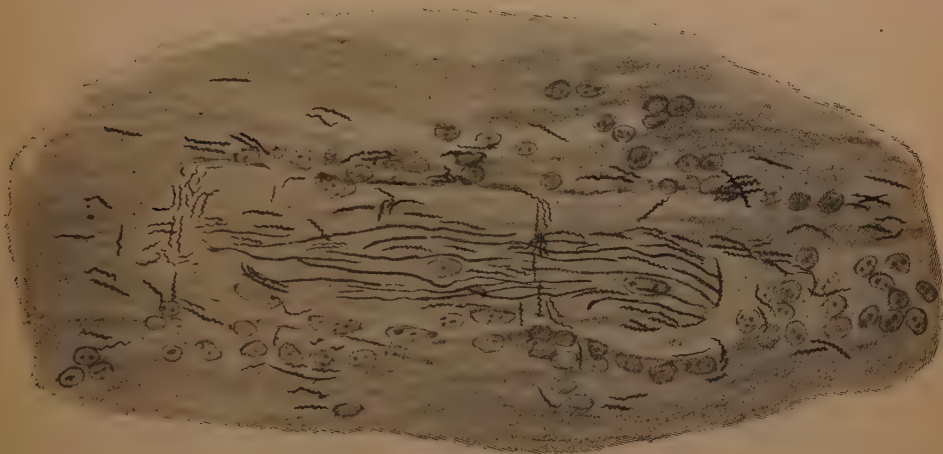


FIG. 27.—(Ehrmann.)

sheath, but also in the nerve fasciculus itself between the nerve fibres. In the space between the nerve fasciculus and the nerve sheath, which, during life, is filled with lymph, spirochaetes lay entangled in irregular masses and clumps, also surrounding, in ring-like formation, the nerve bundle. In the interior of the nerve they were imbedded directly between the nerve fibres. A penetration into the medullary sheath could not be demonstrated, the axis cylinders (silver stain) were intact, symptoms of inflammation were not discovered in the nerve fasciculus.

Ehrmann raises the question whether, analogous to the clinical assumption of an ascending neuritis in leprosy and rabies, there might be found here an explanation for the origin of tabes with reference both to the fact that tabes

almost exclusively begins in the lowest part of the spinal cord, and also that the spirochætes can remain latent for a long time and then again resume their pernicious activity.

In considering this theory, one must not forget, first, that cases of *tabes cervicalis* must then depend upon initial lesions in the region of the face and head, and second, in *tabes* neither in the spinal fluid in life nor in the tissues of the spinal cord and its membranes have spirochætes ever been found. However, the theory that the anatomical position of Schaudinn's spirochæte in the nerve explains the development of specific nervous disease is an attractive one.

**The Influence of Treatment.**—It has often been stated that a not thorough or an insufficient antispecific treatment is the cause of specific disease of the circulatory part of the central nervous system. The practical and very important question, what value and significance the intensity and thoroughness of treatment in the primary and secondary stages of syphilis has towards the prevention of a later involvement of the nervous system, whether it be true syphilitic or metasyphilitic disease, deserves serious consideration. Erb called attention in 1900 to the fact that the majority of the cases of *tabes* follow an apparently light infection, and therefore are apt to escape energetic treatment. Neisser collected 445 cases of *tabes* from the literature and found that 254 of them, 57 per cent., had never received any antisymphilitic treatment. The same opinion, that is, that those individuals are most apt to develop syphilitic or metasyphilitic disease of the nervous system who have not been treated or insufficiently treated, is held by such syphilographers as Fournier, Koposi, Neumann, and by such neurologists as Heubner, Gilbert and Kuh.

In striking contrast to this opinion is the view expressed by Collins, of New York, who from the study of 96 cases of *tabes* concludes that a thorough treatment of syphilis neither prevents nor postpones the development of syphilitic or metasyphilitic nervous disease, which develops later rather than earlier in cases not thoroughly treated.

Eulenburg in 27 cases of *tabes* found that 50 per cent. of them had not been treated, 40.7 per cent. had undergone one



course of treatment, and only 11 per cent. had taken a series of treatment. Dinkler reports 49 patients with tabes, in which 28.6 per cent. had received no treatment, 57 per cent. one course only, and 12.2 per cent. a number of courses. Kron, as a result of his observation of tabes among women, came to the conclusion that antisppecific treatment has no value in the prevention of nervous disease.

In my own experience I have been able to find cases which received a thorough and energetic treatment immediately after the infection and at every secondary outbreak, and two cases which from the time of the infection on took almost uninterrupted treatment, yet within two years after the date of the infection developed nervous disease.

In 35 cases of paresis which came under Schuster's observation there were three which had never received any antisppecific treatment (8.6 per cent.), 21 had taken only one course of treatment (60 per cent.), five cases (14.3 per cent.) two courses, and six (17.1 per cent.) received from three to nine courses of antisppecific treatment.

The specific infection was admitted in 76 cases of cerebrospinal lues. Among these 10 were never treated (13.2 per cent.), 36 patients (47.4 per cent.) had one course, 15 patients (19.7 per cent.) two courses, and 15 patients received from three to six courses of treatment. Schuster was unable to distinguish any difference in the clinical picture in cases which had been previously treated and those which had not been. He describes several cases in which the most thorough treatment had been given and yet these cases presented the severest symptoms from the side of the nervous system. The average period of latency in the untreated and partially treated cases was of no shorter duration than in the cases which had received thorough treatment. Schuster also concluded from his statistics that those who had received one course of treatment became tabetic later than those who had received two courses, and those again developed tabes later than the ones who had taken a number of courses of treatment.

The period of latency in Schuster's 76 cases of cerebrospinal lues, in all of which lues had been admitted, aver-

aged between ten and eleven years. Adding now to these 76 cases 24 cases where the patients admitted having had a soft chancre only, or denied venereal infection entirely, the total number of untreated cases would be 34. The average period of latency for these 34 untreated was 12.2 years—a little longer period than the average for the treated cases.

Schuster also concludes that it has not been proven that previous mercurial treatment can prevent or retard the development of syphilitic or metasyphilitic nervous disease.

Two of my own observations seem to be pertinent here: A young officer, who had received no treatment for his primary and secondary symptoms, four months after infection developed brain syphilis, from which he died four months later. In another case, with an unusually severe primary lesion, the antispecific treatment was administered energetically and thoroughly, yet during treatment symptoms of basilar meningitis with psychic disturbances appeared.

Oppenheim takes, however, a somewhat different view of the question. He says that in two individuals who have been infected, other things being equal, the one who has received a thorough antispecific treatment is to a lesser extent threatened with a brain affection than the one who has received insufficient treatment or no treatment whatever.

Recently Mattauscheck (Vienna), after a careful study of this question among Austrian officers who furnished the opportunity for continuous observation over a long period of years, came to the conclusion that those who had received thorough treatment stood the best chance of remaining free from nervous involvement.

In only one thing do the authorities on this subject seem to agree. This is, from these observations one must not conclude that syphilis should not be thoroughly treated.

**The Influence of the Severity of the Course on Nervous Involvement.**—The opinion first expressed by Broadbent, Fournier, and Erb, and later confirmed by many other observers, that brain syphilis, and especially disease of the arteries of the brain, was apt to occur in cases where the primary and secondary stages were mild, has much in its favor. I can by no means, however, confirm this view in all

of my cases. A number of my cases ran a severe course from the beginning, the primary lesion took on a malignant character, the eruption instead of being macular was papular and pustulopapular, and new exacerbations occurred during antispecific treatment. Oppenheim also reports brain syphilis after both mild and severe primary and secondary symptoms.

**The Influence of Extragenital Infection.**—Extragenital infection does not bear any special significance to brain syphilis. Hahn reports 307 cases of extragenital infection, and in none of these cases did syphilis of the brain occur.

**The Influence of Head Injuries.**—Considerable has been written concerning the influence of head injuries in the development of brain syphilis. My own observations in this regard lead me to the belief that even here we should not overestimate the influence of trauma. Every year at the Eppendorf Hospital I have the opportunity of observing about 150 more or less severe injuries of the head, and among these patients there is a fair proportion who have acquired syphilis. I can recall only two cases where symptoms of brain lues developed after trauma.

Bailey from his observations comes to the conclusion that while one *a priori* cannot deny the creation of a *locus minoris resistentiæ* through trauma, nevertheless syphilis of the brain occurs extremely seldom after injuries of the head.

**The Influence of Mental Work.**—It has been asserted and also disputed that the brain worker is more susceptible to brain syphilis than the man who works with his hands. In a review of my material, both in the hospital and in my private practice, I am not able to discover any more frequent occurrence of brain syphilis in the brain worker than in the ordinary laborer. Tarnowsky in 100 cases of cerebral lues was able to demonstrate only six cases in which the causative factor appeared to be intellectual overactivity.

Psychic trauma and acute infectious diseases may also be regarded as of insignificant influence as causative factors.

**The Influence of Alcohol.**—On the other hand, alcohol predisposes a syphilitic patient to an outbreak of brain

syphilis. Among my cases of brain lues chronic alcoholism often exists. Lochte in his excellent monograph on this subject says that syphilis in alcoholics often is a *syphilis gravis*. Tarnowsky's statistics makes clear the rôle which alcohol plays in lues cerebri. In 100 patients with syphilis of the brain, he finds 45 who were habitual drunkards. However, it should be stated that the organ most often affected in alcoholics with syphilis is not the brain but the liver.

**Neuropathic Heredity.**—The etiological importance of a congenitally weak nervous system should also be considered. Oppenheim, Fournier and Lamy all regard a poor nervous inheritance as having some influence in the causation of parasymphilitic diseases. In 185 cases of lues cerebri, spinalis and cerebrospinalis there was in 24 no history regarding heredity, in 136 a good family history, and in 25 a poor one.

**Symptomatology of the Arteritic Form of Cerebral Syphilis.**—We come now to the symptomatology of brain lues and will first consider the clinical symptoms of the arteritic form. Among the manifold symptoms which the pathology of syphilis produces, one is struck with the frequency of the occurrence of symptoms of a monoplegic and hemiplegic nature. We have previously called attention to the fact that the blood-vessels suffer not only because of genuine syphilitic disease, but also secondarily through the involvement of their environment, the nervous tissue itself as well as the brain coverings, and that in either way lumen closure may be brought about with the consequent result to the nerve tissue of softening and necrosis.

Although the various specific processes are found very often in brain involvement, indeed most often in combination, nevertheless the clinical manifestation of brain syphilis in the form exclusively of Heubner's arteritis not infrequently occurs.

**The Time of Occurrence.**—All observers agree that the affection of the arteries may occur soon after the specific infection. A great number of statistics exist on this point. We find in these statistics cases where half a year after the



infection a paralysis referable to lues appeared. Kahler reports a softening of the pons as the result of an arteritic basilar thrombosis in a patient whose primary lesion was not yet entirely healed. On the other hand there are cases where a specific paralysis develops years after the infection. In such cases, we must consider whether we have to deal with a specific arterial disease or with the ordinary arterial sclerosis.

Gowers in an analysis in 56 cases of specific hemiplegia found that the paralysis in one-fourth of the cases occurred within the first two years after the infection; the other cases, with the exception of two, one of which took place 18 and the other 19 years afterwards, were distributed within a period of 12 years from the date of the infection. In one case of Gowers's series the paralysis appeared three months after the infection.

According to Fournier the arteritic hemiplegia occurs most often between the sixth and tenth year.

My own cases of arteritis luetica show a wide difference in the time of occurrence, varying from 7 months to 27 years, the greater number occurring in the fifth, sixth, and seventh years after the primary lesion.

**Age of the Patients.**—The age of the patients ranged, in the women from 24 to 56 years, in the men from 18 to 55 years. Both Siemerling and Gowers have reported cases of endarteritic paralysis in children who were afflicted with hereditary lues.

**Prodromal Symptoms.**—In many cases the attack is preceded by prodromal symptoms. These are headache, dizziness, insomnia, changes in the disposition in the form of irritability, loss of ambition, incapacity for continued mental effort, and impaired memory. These symptoms must not, however, be considered as characteristic of specific endarteritis; they may also appear in other manifestations of brain syphilis. The triad, headache, dizziness, and failure of memory, may be regarded as a prodromal symptom-complex in arteriosclerosis, cerebral apoplexy and brain atrophy. One must further add that both light and severe

attacks of apoplexy occur not infrequently without the slightest warning in the form of prodromal symptoms.

The knowledge that these symptoms are often precursory of severe manifestations of arteritis is extremely important, because they represent danger signals and because a timely and efficient therapy is able to prevent, under favorable circumstances, the development of later-coming brain lesions.

**Headache.**—The headache may be very severe and is usually located on different parts of the head; it is seldom localized. It is most often diffuse in character and may be described as dull and stupefying, rather than as boring and agonizing. It is sometimes, though not always, worse by night than by day. It is seldom constant, and when intermittent is apt to be more severe. It may disappear for weeks and months, only to reappear again without any apparent cause.

Headache may remain for a long time the only symptom, and it is advisable in all cases where the patient complains of severe headache for which no cause can be discovered to at least suspect syphilis.

**Dizziness.**—Dizziness occurs frequently in short attacks, but may also be more or less permanent in character. Like headache it may be the only symptom for a long time, but monosymptomatic dizziness is far less frequent than monosymptomatic headache. As a rule the dizziness is lessened when the patient lies down.

**Insomnia.**—The insomnia may be transient or persistent in nature. Either the patient awakes in the morning unrefreshed from his sleep or is absolutely unable to sleep at all.

Tschisch calls attention to the relative frequency of suddenly appearing and intractable insomnia in the beginning of brain syphilis, which he considers especially important for the diagnosis where symptoms of neurasthenia are lacking. It appears to me doubtful whether the thickening of the temporal artery in the early stages is as frequent as Tschisch would have us think; he finds it in every case.

**Psychic Disturbances.**—Among the psychic symptoms the one most often present, and for the patient the most dis-

turbing, is the impaired capacity for work. Also the abnormal irritability is apt to be a most annoying symptom; the loss of memory is less intense in character. In some cases the loss of intelligence, the lack of general and special interest, makes the patient dull and stupid. Add to these symptoms a tendency to weep, and the clinical picture presented causes one to think of the dementia from general paresis. In rare cases the only general symptom may be a disturbance of speech in the form of bradylalia.

**Intoxicated-like State of Heubner.**—Heubner describes a condition somewhat resembling an intoxicated state, a form of semiconsciousness. The same condition has also been described by Rumpf and Oppenheim. The patients are able to do all sorts of things, while in this semiconscious state, but a remembrance of the same is lacking.

Periods of excitement may alternate with periods of apathy. In other cases there occur longer or shorter attacks of falling asleep. A subsidence of this condition is possible, but it should always be regarded as a severe symptom, because it is often a forerunner of a severe paralysis or of a coma preceding death. The following case illustrates this condition:

A woman fifty-six years old, from whom after the most painstaking inquiry no history of syphilis could be obtained, was sent to the hospital by an experienced physician, with the diagnosis *delirium alcoholica incipiens*, in spite of the fact that no evidence of potus could be adduced. The objective symptoms were hyperæmia of the optic discs with indistinctness of their borders, increased activity of the tendon reflexes, and a diffuse sensitiveness of the head to percussion. The patient had hallucinations, lay half sleeping and gave only partial and incorrect responses to questioning, her recollection of events was poor, and when completely awake she talked at times in a foolish manner. She now and then busied herself with some work without being fully conscious of what she was doing, and later had no recollection of what she had done. In spite of energetic antispecific treatment she did not improve and a week later died. The

autopsy showed an extensive disseminated endarteritis and periarteritis gummosa.

There are many cases in which general symptoms only,

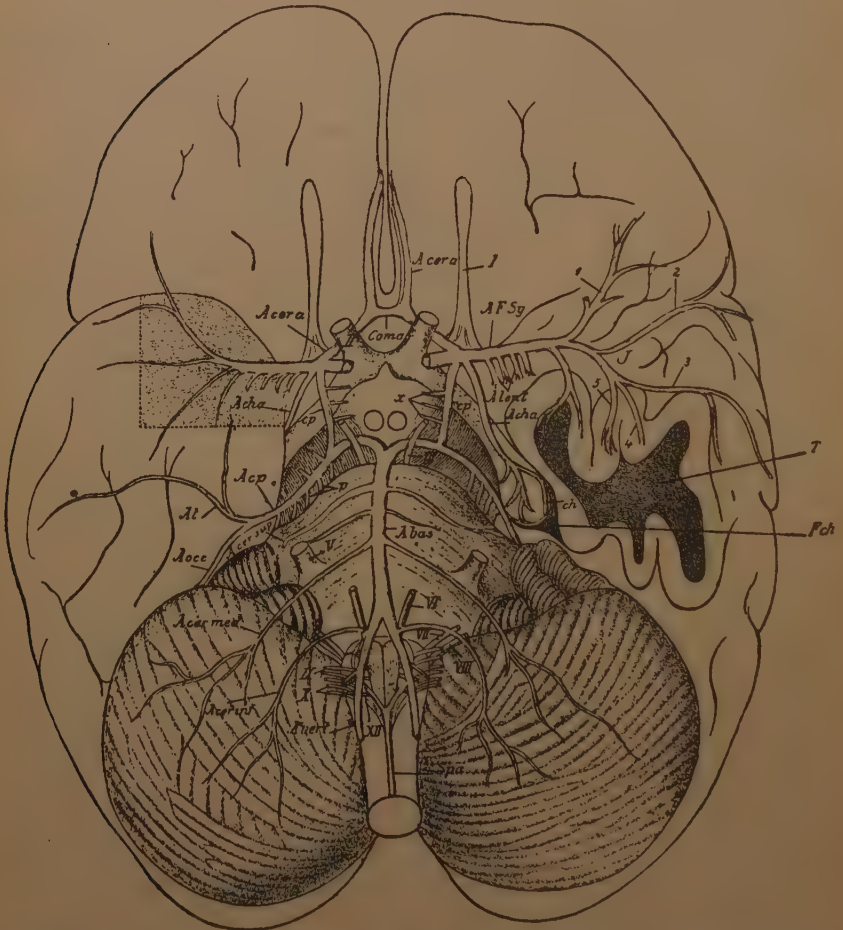


FIG. 28.—Arteries of the brain-base. (Monakow, "Brain Pathology"; Nothnagel's "Special Pathology and Therapy," vol. ix.) *T*, separated temporal lobes; *a. cer. a.*, arteria cerebri anterior; *con. ant.*, arteria communicans anterior; *c. p.*, arteria communicans posterior; *a. f. Sy.*, arteria fossae sylvii; *a. lent.*, arteria lenticularis; *a. ch. a.*, arteria choroidea anterior; *a. c. p.*, arteria cerebri profunda; *a. t.*, arteria temporalis; *a. occ.*, arteria occipitalis; *a. bas.*, arteria basilaris; *a. cer. sup.*, arteria cerebelli superior; *a. cer. med.*, arteria cerebelli media; *a. cer. inf.*, arteria cerebelli inferior; *a. ver.*, arteria vertebralis; *s. p. a.*, arteria spinalis anterior; *I-XII*, cranial nerves; 1-5, cortical branches of the fossae sylvii.

such as irritability, inability for mental concentration, and loss of memory, are present, and localized symptoms appear either late or not at all. In this class of cases one is more



inclined to think of a psychosis or brain tumor. These cases are not infrequently unresponsive to specific treatment. Cases may also begin apparently as a severe apoplexy, and on postmortem no hemorrhage or area of softening will be found, but only a Heubner's endarteritis.

**Arterial Disease on the Base of the Brain.**—We have mentioned before that Heubner's arteritis affects most often the arteries of the brain. We can see at a glance the blood supply by consulting Fig. 28. The large arterial trunks are represented through the basilar artery, which sends the large branches, the *arteria cerebelli superior* and the *arteria profunda cerebri*, to the pons and brain stem. There also can be seen the *arteria fossæ sylvii* which supplies the centre of the brain, through the *arteria corporis callosi* and the *arteria lenticularis*.

Looking at Fig. 29, one observes that the interpeduncular region, for which specific processes appear to show a predilection, is richly provided with arterial supply, both from the carotid and basilar arteries.

The arterial relations have been carefully studied by Heubner and Rumpf. The arteries which are given off at right angles from the *arteria fossæ sylvii* are end arteries, in the sense of Cohnheim, that is, the brain region supplied by them has no possibility of a collateral blood supply. This explains why so often diseases of the basilar arteries present the same clinical picture: hemiplegia on the one hand and symptoms of pons affection on the other.

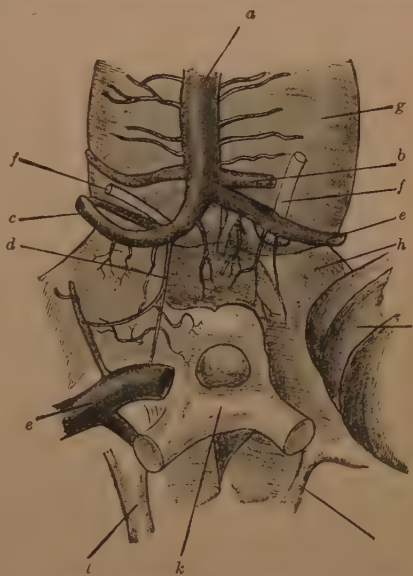


FIG. 29.—Arterial ramification of the peduncular region of the brain. One sees numerous branches given off from the *arteria cerebri posterior* and the *arteria communicans posterior*. *a*, *arteria basilaris*; *b*, *arteria cerebelli superior*; *c*, *arteria cerebelli posterior*; *d*, *arteria communicans posterior*; *e*, *carotid interna*; *f*, *nervus oculomotorius*; *g*, *pons*; *h*, *crus cerebri*; *i*, *lobus temporalis*; *k*, *chiasma nervorum opticorum*; *l*, *tractus olfactorius*.

**Variations in Blood-pressure.**—There is not always a complete shutting off of the vessel lumen, but very often only a partial obstruction to the passage of the blood exists, depending on the degree of narrowing in the arterial lumina. Where such conditions exist we naturally find variations in the blood pressure. The arteries on the distal side of the narrowed lumina would be subjected to less pressure and thus receive a diminished blood supply, and then gradually later on would become filled with blood again.

This variation in blood-pressure and consequent disturbance of nutrition is the anatomical explanation of the attacks of dizziness as well as the transient paralyses so often observed. The transient paralysis may last only a few minutes, but can persist for several hours and even longer. Paræsthesias appear along with the paralysis, and it not infrequently happens that the disturbance stops with the paræsthesia and a genuine paralysis does not develop. Either only one extremity is affected or an upper and lower extremity, or these together with the face and speech. It frequently happens that the speech alone is affected or the speech in combination with paræsthesias in the face and tongue.

**Symptoms of Motor Irritation.**—The transient circulatory disturbances may also produce symptoms of motor irritation. We observe then the extremities attacked with light clonic contractions without any clouding of the consciousness. Sometimes one sees one extremity after the other become paralyzed. In the course of a day the gradually increasing thrombosis in the artery may lead to an ascending or descending complete hemiplegia, while at the same time the consciousness remains absolutely intact.

**Transient Paralysis.**—Transient paralyses often recur, it may be after days, weeks, or months. In some cases they may still remain transient, in others after several recurrences become more or less permanent. A long existing paralysis, which has almost entirely receded under anti-syphilitic treatment, may also return after months and years have passed, and in the same part of the body. This, to a certain extent, is characteristic of a syphilitic paralysis.

It is, moreover, easy to understand when one considers that the anatomical changes once started cannot again become retrogressive, that also in these places where the circulation has been restored through the changes in the lumen a strong predisposition exists to the formation of another thrombus. The report of the following cases will illustrate this.

A laborer thirty-four years old, four years after a specific infection, was received at the Eppendorf Hospital suffering with a right-sided hemiparesis which had developed without any accompanying apoplectic symptoms. Under antispecific treatment he recovered in the course of about four weeks without any residual paralysis remaining. Eight months afterwards the patient was again received at the hospital on account of severe headache. At the same time he had, intermittently, clonic spasms in the right hand, accompanied by paræsthesias and a right hemiparesis. By means of large doses of potassium iodid his symptoms again disappeared. Six months later the same patient presented himself with a return of his headaches, and in addition diplopia and paræsthesias and weakness in the right lower extremity. Objectively, besides the paresis which had returned for the third time, there was a weakness of the right abducens and a mild double optic neuritis. Under suitable treatment these symptoms again cleared up, leaving only a partial optic atrophy.

**Apoplectic Symptoms.**—The acutely developing hemiplegia may appear accompanied by the symptoms of a severe apoplexy, complete loss of consciousness, vomiting, convulsions, or with mild symptoms such as light disturbances of the sensorium, dizziness, nausea, or indeed without any of these symptoms whatever. The presence or absence of these accompanying symptoms cannot be regarded in themselves as having any special significance in distinguishing between a specific or non-specific hemiplegia.

The form of paralysis also does not differ from the paralysis of the ordinary arteriosclerosis, except that it is not apt to be so severe as the latter, because hemorrhages of the specific variety are of less frequent occurrence.

One rarely gets a chance to autopsy a case of syphilitic hemiplegia, because the symptoms usually disappear under treatment. Twice, however, because of complications, I have had this opportunity. Both cases were in young persons. In one case the hemiplegia developed two years after the infection, in the other, four years afterwards. The paralysis in one case had disappeared, in the other a condition of contracture had developed. In one case there was a small area of necrosis in the internal capsule, in the other a large area, both due to an arteritis and consequent stenosis of the *arteria fossæ sylvii*.

Although one is accustomed to attribute monoplegias or cerebral facial paralysees to disturbances in a circumscribed portion of the cortex, numerous observations prove that central lesions may also produce these isolated disturbances of cortical function. Isolated convulsions likewise do not necessarily mean a cortical localization of the trouble. The situation is different, however, in convulsions appearing in a part previously paralyzed.

The aphasia is usually a motor aphasia, and is in combination with a monoplegia or a hemiplegia or a paralysis of the facial or of the tongue; it may, however, appear as the only symptom.

Heilbronner reports a case of word blindness and word deafness due to a syphilitic cause. The aphasia is frequently transient in character, in some cases lasting a few minutes, in others several hours, and still others a number of days.

**Tripiegia.**—A relatively frequent type of syphilitic paralysis is tripiegia, where the paralysis involves both extremities on the one side of the body and one extremity on the other.

**Pons Involvement.**—Another form presents the clinical appearance of a pons affection. In this form there is involvement of the *arteria basilaris*. Affections of the basilar artery are, as a rule, serious. The following case represents disease of the basilar artery.

A strong man in the prime of life, father of three healthy children, after prodromal symptoms in the nature of headache of several weeks' duration, suddenly became affected



with disturbances of speech and swallowing and double vision. Examination revealed an abducens paralysis, difficulty in swallowing and articulation, and a left hemiplegia. Death occurred after three days. The autopsy demonstrated a marked endarteritis of the basilar artery about one-half cm. in length, with secondary processes of softening in the pons. There were also in the various branches of the circle of Willis multiple endarteritic lesions.

**Sensation.**—Sensation is only in rare cases severely affected, and in the majority of cases disturbances of it are entirely lacking.

**Hemianopsia.**—Hemianopsia may occasionally be found in those cases where the optic radiations are affected and the lesion may occur anywhere from the chiasm to the occipital lobes. This symptom is met with less often, however, than in cerebral arteriosclerosis and brain-tumors.

The following case is an interesting one in this connection: It concerns a man 27 years old, who eight years previously had contracted syphilis, taken a course of inunctions, and since then had observed no symptoms of his syphilis. Six days before coming under my care while working he was suddenly seized with a severe attack of dizziness, vomited several times, and complained of severe pain in the forehead and occiput. Convulsions did not appear. He observed soon afterwards that he could not see towards the left.

Examination of the field of vision showed a left hemianopsia with normal eye background and normal pupils. There was a slight weakness in the left facial around the angle of the mouth, also of the right abducens. The two last symptoms disappeared in the course of the next seven days. The extremities were not involved, nor was the speech. The skull over the right occipital lobe was tender to percussion. The other organs were normal.

Under mercurial treatment the headache and dizziness disappeared, but the hemianopsia remained. The patient again took up his occupation as masseur. Four years later he had another attack of dizziness, but not as severe as the first. Another careful examination revealed the same

condition in the field of vision, but no other anomalies on the part of the nervous system. The attacks of dizziness again disappeared and the patient returned to work. Six months later he died of a croupous pneumonia in the right lung.

At the autopsy the most of the cuneus and the portion of the precuneus bordering on the parieto-occipital fissure were destroyed and occupied by an area of softening. The rest of the brain was normal. In the basilar artery as well as the arteries in the circle of Willis there was found a moderate degree of arteriosclerosis. As evidences of syphilis in other organs of the body two gummatous nodules were found in the liver and in the right testicle an indurated orchitis.

Anomalies of the pupils in specific hemiplegia are not infrequent. Loss of the pupil reflexes, the loss of the reflex to light, slowness of contraction of the pupil to light, irregularity of the pupils in size and shape may sometimes be observed.

**The Course.**—The course of the hemiplegia varies. It may pass away quickly or slowly, it may terminate in a paresis with or without consequent increase of the tendon and decrease of the superficial reflexes, or finally a contracture hemiplegia may develop. The improvement in the lower extremities is usually much greater than in the upper, as is the case in the ordinary hemiparesis, but sometimes the reverse is true: the upper extremity improves greatly, while the lower lags behind.

In those cases in which the paralysis entirely regresses or only a paresis remains, the remaining psychical functions may remain absolutely intact throughout a long life, always provided of course that syphilis causes no further damage. In other cases the intelligence is disturbed, the memory suffers and the entire mental capacity of the patient sinks in a marked degree, similar to the condition sometimes encountered in the hemiplegia of old age. In the specific form, however, this condition may also be met with in young persons. It also happens that an arteritic hemiplegia is followed after a number of years by a general paresis.

The speech disturbances have no points of differentiation from aphasia occurring in the hemiplegia of advanced age.

The following case representing an isolated facial paralysis in combination with general psychic symptoms is interesting:

A laborer thirty-seven years old had an initial lesion three years before, he had undergone one course of inunctions, and was temperate in the use of alcohol and tobacco. He was, until his present illness, always healthy and ambitious to work. Three months previous to his entrance into the hospital, without any assignable reason he lost interest in everything around him, was forgetful, could only with difficulty keep from weeping, laughed without cause, and did nothing but sit and stare into space. He had no ideas of grandeur and did not complain of headache or dizziness. The only objective sign was a slight right-sided paralysis. All these symptoms disappeared completely under a three months' mixed treatment.

Another case in which the symptoms are entirely of a psychic nature is also of interest here.

A ship's officer, thirty-eight years old, was sent by his physician to the hospital, because recently his mental capacity had failed so rapidly. He sat around in a stupid manner, seemed to be unable to write, was indifferent and listless, and his memory was very poor. His sleep was fairly good, but he complained of a severe headache, which was diffuse in character. He had always been strong and healthy, did not use alcohol, but six years before had acquired syphilis. His secondary symptoms, from his description, had been severe and he had received thorough treatment for them. At the time of his entrance into the hospital, outside of the old signs of former secondary lesions, his only symptoms were a well-marked dementia, with none of the earmarks of a paresis, and no objective symptoms from the side of the nervous system, except very active tendon reflexes. He soon developed a complete disturbance of consciousness, had to be fed with a tube, and four months later died from decubitus and aspiration pneumonia.

The autopsy revealed, outside of a moderate arteriosclerosis of the ascending aorta, no abnormalities in the chest or abdomen. The basal arteries of the brain showed macroscopically Heubner's changes, microscopically a marked endarteritis, meso- and peri-arteritis in the trunks on the base as well as in the arterioles of the cortex. Examination of the portions of the cortex did not reveal the changes in ganglion cells which are found in paresis.

Charrière and Klippel have classified the various possibilities in the termination of specific paralysis in the following manner: the "*forme intellectuelle*," the "*forme parétique légère et aphasique*," the "*forme paralytique grave*," and the "*forme apoplectique*."

**Diagnosis.**—The diagnosis, as a rule, is not difficult. If a hemiplegia occurs in an individual before the age of 45, before one expects to find arteriosclerosis, and one is also able to exclude heart disease and disease of the kidneys, and those affections such as leukæmia, scurvy, pernicious anæmia and alcoholism, which lead to a hemorrhagic diathesis, and if there exists no acute condition which might cause an embolus, syphilis is naturally to be thought of as the cause of the apoplexy. The diagnosis becomes more probable, of course, if there is a history of syphilis. On the other hand, if there is no history nothing is proven. The majority of cases occur later than the period at which most of the constitutional symptoms in the form of leucoderma, alopecia, and general enlargement of the glands are found. The eruption disappears without leaving any scars, and very often the initial lesion, even in men, leaves no trace. In such cases the Wassermann reaction will often disclose the cause.

The success of the therapy cannot always be regarded as a determining factor in the diagnosis, because we know that hemiplegias which are not of specific origin may improve or even entirely disappear. Our chief dependence in the diagnosis must be on the proof of a previous syphilis and the exclusion of all other etiological factors.

The behavior of the four reactions in uncomplicated cases of specific endarteritis may be expressed as follows:



The Wassermann reaction is usually positive—may, however, be negative.

If one estimates the intensity of the reaction according to Zeissler, the result is generally that the intensity is only of the first or second degree; there is seldom a strong reaction. The Wassermann reaction in the spinal fluid is frequently positive, usually only with 0.4 c.c. or larger quantities of fluid. The lymphocytosis is mostly moderate and may be entirely lacking.

The Phase I reaction is also generally slight; not infrequently all four reactions may be absent.

The two following cases will illustrate the behavior of the four reactions in syphilitic arteritis:

A woman twenty-four years old, one and one-half years after a lip infection, developed an arteritic hemiplegia.

Wassermann in blood + + +. Wassermann in spinal fluid + + + (with 0.2 c.c.). Phase I +. Pleocytosis + +.

A merchant, fifty years old, had five years ago an arteritic hemiplegia. The hemiplegia remained unchanged. His syphilitic infection was of 11 years' duration.

Wassermann in blood -. Wassermann in spinal fluid - (with 1 c.c. of fluid). Phase I +. Pleocytosis -.

**Differential Diagnosis Apoplexy.**—In the consideration of the differential diagnosis one should mention that occasional cases of apoplexy have been reported in comparatively young persons, where the autopsy revealed no apparent cause.

The relapsing type of hemiplegia as well as triplegia sometimes occurs in individuals who have not yet attained the age of arteriosclerosis, who have sound internal organs and who never have had a specific infection.

**Brain Tumor.**—Tumor of the brain may exhibit for a long time the general symptoms of headache, insomnia, and weakness of memory, and then suddenly either with or without apoplectic symptoms develop a hemiplegia without any discoverable increase in the intracerebral pressure.

Brain tumor may also manifest itself as an acute hemiplegia with scarcely noticeable or with no prodromal symptoms whatever.

**Multiple Sclerosis.**—Transient paralyses can occur in multiple sclerosis. This usually occurs in young persons with healthy internal organs, and may attack individuals who have had a previous specific infection. Although the further course of the disease as a rule renders the situation clear, one must not forget on the other hand that multiple sclerosis not infrequently shows very marked improvement, and because of this gives further support to the assumption of a specific hemiplegia.

The four reactions are especially valuable in differential diagnosis here.

**Bright's Disease.**—Bright's disease in the form of uræmic hemiplegia may also present difficulties in differential diagnosis. I saw a case in which there existed the combination of a former brain syphilis and Bright's disease. The epileptic convulsions which the patient developed I regarded as caused by the syphilis. The examination did not give any positive evidence of Bright's disease. The autopsy, however, proved that the convulsions were due to the nephritis instead of the brain syphilis.

**Hysteria.**—Hysterical hemiplegias in syphilitic patients may also cause mistaken diagnoses.

Severe attacks of migraine may not only cause transient motor aphasia and hemianopsia, but also produce hemiparesis. If a person with such attacks has also lues, a differentiation as to the nature at the time is not possible, and a further observation of their course will be required. Apoplectiform attacks occur in dementia paralytica and may exhibit symptoms of monoplegia, hemiplegia, and isolated aphasia.

**General Paresis.**—When dementia paralytica presents only general symptoms, such as dizziness, loss of memory, and decreased capacity for work, as it not infrequently does, or as also happens when an apoplectiform attack occurs before the development of somatic symptoms, such as changes in the form, size, and function of the pupils, and disturbances of speech, one is justified in the assumption that the cause is due to the arteritic form of brain syphilis. In the great majority of these cases the further course will

soon enable one to distinguish between the two conditions.

**Tuberculosis.**—Tuberculosis may also lead to confusion in the diagnosis. A solitary tubercle, which develops in the pons (a favorite location for solitary tubercle), can for a long time simulate a slow-forming basilar thrombus. If the patient happens to have had a previous infection of syphilis the assumption of a specific arteritis of the basilar artery is naturally first considered.

When a patient has attained the age of arteriosclerosis a definite distinction cannot be made between a specific arteritis and one due to arteriosclerosis. Existing symptoms of a florid syphilis when present will help to clarify the diagnosis.

**Heart Disease in Syphilitics.**—Luetics may through some other disease contract a heart affection. In such cases it is sometimes an open question which one of the two diseases is responsible for the symptoms of paresis.

**Arteriosclerosis in Young Syphilitics.**—We must also take into consideration that we sometimes find an arteriosclerosis in comparatively young individuals which has been developed by syphilis, but is in itself non-specific in character, and that this condition may be the cause of the existing brain disease.

**Summary.**—The most important factors in the differential diagnosis must be continually kept in mind. If a paralysis occurs in a young person or a person of middle age in whom both the central and peripheral arterial system is normal, and in whom there exists no other demonstrable cause for the formation of embolic, thrombotic and apoplectic processes, in whom syphilis has either been proven or seems probable, and in whom transient paralyses in the form of either mono-, hemi-, or triplegia occur, which either entirely disappear or show marked improvement, and which not infrequently leave the qualities of the mind unimpaired, we are justified in regarding a specific arteritis as the causative factor. In all such cases the application of the four reactions and their findings should never be neglected in making a differential diagnosis.

## IV

### SYPHILITIC CEREBRAL MENINGITIS

THE membranes of the brain seem particularly susceptible to syphilis. If Wunderlich should state at the present time that there were no characteristic symptoms of brain syphilis, in the light of the rich experience of the last 25 years, we should feel called upon to place a certain degree of limitation upon his statement. It was Virchow who first called our attention to the juxtaposition of tumor formation and regression in syphilitic tissue. He saw, on the one hand, in the reabsorption and shrinking of the nerve compressing gumma, and, on the other, in the increase of diseased processes through recent destruction and incomplete absorption, the explanation of the rapid changes in the clinical symptoms which frequently occur in syphilis of the central nervous system. Heubner had already called attention to the fact that in many cases the appearance and disappearance of symptoms of paralysis and irritation dominated the clinical picture. Oppenheim has expressed himself in this regard very distinctly. He says: "We know of no other neoplasm in which both of these processes, growth and retrograde metamorphosis, in a certain sense go hand in hand and are so closely related, so that the scarcely formed neoplasm is destroyed and upon the site of its location another immediately develops."

**Incompleteness and Transient Character of the Clinical Symptoms.**—When we combine the changes in the lumina of the large vessels on the base of the brain, and the conditions which are produced in the interior of the brain through these changes, as well as the qualities of the constant change in the affected tissue, we are better able to understand the clinical peculiarities which brain lues exhibits. We can also understand why it is just this class of cases, as Naunyn has statistically proven, which are the most favorably influenced by antispecific therapy. We ob-



serve in these cases when treated with mercury and iodid rapid improvement and recoveries, which we do not see in the non-specific syphilitic processes in the arteries.

**Multiplicity of Symptoms.**—Another factor which is relatively characteristic of brain syphilis is the multiplicity of symptoms. Specific basilar meningitis can not only through pressure cause arteritic symptoms, such as we have discussed in the last chapter, but also cause the involvement of the cranial nerves, either collectively or singly, or in various combinations, unilateral, bilateral, or alternating.

The syphilitic infiltration on the base may only involve the meninges, but can involve the brain tissue itself as well.

The nerve tissue, as we have seen, may become affected through contiguity, and the condition of encephalitis gummosa then exists, or it becomes compressed through the uniform infiltration of gummatous masses or isolated nodules, or through disease of the arteries in the meninges, thrombosis and obliteration of the lumina are produced and the consequent secondary softening and necrosis of the nerve substance then follows.

We should remember that the arteries which supply the cortex of the brain and the medullary tissue beneath are first found in the pia, where they give off branches before entering the brain substance.

The etiology of specific cerebral meningitis does not differ from that of syphilitic arteritis. What has been said about the latter, in regard to heredity, the probable influence of the intensity and type of the infection, the age of the patient, the form of therapy, the later exacerbations, also with reference to trauma, alcohol and other injurious factors, will apply equally as well to the former.

For practical reasons we will consider the meningitis of the convexity and base of the brain separately. The difference in the localization of the inflammation causes a difference in the symptoms. However, it cannot be definitely determined in many cases whether certain symptoms are caused by disease of the convexity or base, and whether or not a combination of both forms does not exist, as the

pathological examination in the majority of cases shows.

**The Behavior of the Four Reactions.**—The Wassermann reaction in the blood is frequently positive, in about 60 per cent. of the cases; if estimated according to Zeissler's method, weakly or moderately positive. The Wassermann reaction in the spinal fluid may be positive with 0.2 c.c. of fluid; more often only becomes positive with larger amounts of fluid. In rare cases even the spinal fluid Wassermann may remain negative. The Phase I reaction is almost always positive, usually strongly positive. Pleocytosis seldom fails. Usually there is a moderate increase in the lymphocytes. The following cases will illustrate the reactions:

**CASE I.**—A man thirty-eight years old was infected with syphilis six years ago. During the past year he has suffered with attacks of epilepsy. At his examination a right-sided hemiparesis with slight motor aphasia was found. At the same time there was well-marked sensitiveness to percussion in the region of the left anterior central convolution.

Wassermann in blood +. Wassermann in spinal fluid + (from 0.4 up). Phase I +. Pleocytosis + +.

The patient died after a week in the hospital.

Postmortem: Meningitis gummosa on the surface of the left central convolution. Hemorrhages in the left internal capsule, which had perforated into both lateral ventricles.

**CASE II.**—A woman thirty-two years old, infected by her husband three years ago. Two years after her infection developed a right hemiparesis.

Objective symptoms: Right hemiparesis, slowness of the pupil reaction to light, slightly stuporous.

Wassermann in blood +. Wassermann in spinal fluid + (from 0.5 c.c. up). Phase I +. Pleocytosis +.

Postmortem: Encephalitis gummosa of cortex, both left and right, microscopic (Dr. Ranke-Heidelberg) encephalitis and meningitis gummosa. No evidence of a paresis.

**Symptoms of Specific Meningitis of the Convexity.**—Not infrequently meningitis of the convexity is ushered in with general symptoms; local symptoms may be lacking, because there are no large arteries in this region, the collateral circulation is exceedingly rich and none of the cranial nerves

originate there. On the other hand, disease of the convexity can cause certain characteristic symptoms which permit of a localizing diagnosis. We may find the appearance here of symptoms of irritation and paralysis, which are caused by an involvement of the motor cortical centres, such as monoconvulsions and monoparesis.

**Headache.**—The most frequent and almost never-failing general symptom is the headache. It may, for a long time, precede all other symptoms, may be localized to one spot or diffuse in nature, dull or severe, and not infrequently the patients are stupefied by it. Frequently—however, not so frequently in my experience as Fournier describes and as the text-books since then would have us believe—the pain becomes worse during the night. The headache depends on an affection of the dura, for there are no pain-supplying elements either in the arachnoid and pia or in the brain-substance itself. Sometimes one finds in such cases a local tenderness to percussion, another symptom for the assumption of superficial disease of the brain. The headache may appear soon after the infection, or years may pass before it makes its appearance. The following cases will illustrate this:

A coachman, forty-five years old, twenty years after a syphilitic infection, became affected with severe headache and at the same time dizziness. The headache was so severe that the patient sat around in an apathetic manner, and at times, for short periods, was unconscious. There was no vomiting and no convulsions; objectively the internal organs and nervous system were normal. Under a three weeks' treatment, with large doses of potassium iodid, the pain entirely disappeared. Two years later the patient suffered a relapse, and again presented the same severe stupefying headache, which this time, under an energetic mixed treatment, disappeared in two weeks.

The next case developed a specific headache one year after the infection, at the same time exhibiting secondary symptoms in the skin and mucous membrane.

A married woman, twenty years old, complained for six weeks of an exceedingly severe headache, which tortured her

day and night, so that she was incapable of thinking or sleeping. At the same time she had nausea without vomiting. It was ascertained that her husband had contracted syphilis a year before his marriage, and that he had taken treatment for secondary symptoms within the last six months. Physical examination of the young woman showed secondary symptoms, both in the skin and mucous membrane. The objective symptoms on the part of the nervous system were diffuse sensitiveness of the head to percussion. All movements of the head were painful, the papillæ of both optic nerves hyperæmic, tendon reflexes of both upper and lower extremities very active, and sensations of dizziness, and swaying in standing and walking. With ten inunctions of 6.0 each of unguentum ciner. all the symptoms disappeared entirely.

It is not at all infrequent that a syphilitic headache occurs early and also late, monosymptomatic after an infection, so that in every case of severe and stubborn headache one should at least think of syphilis. One very often finds cases in which along with the headache the only symptom is an anomaly of the pupil, of which the following case is an example:

A woman, thirty-seven years old, who had been infected with syphilis twelve years before, was taken sick with an extremely severe headache and occasional vomiting. Objectively, in addition to a diffuse sensitiveness of the skull to percussion, there was anisocoria (right > left) and sluggishness in contraction of both pupils. Antispecific treatment of four weeks' duration cured the headache completely. The pupil reaction on both sides became normal, but the anisocoria remained.

**Psychic Anomalies.**—The psychic anomalies are quite characteristic. Attention has been called to the fact that the headache is often so severe and continuous that it produces disturbances of consciousness, such as apathy and general dulness. The dream- and intoxicated-like state which was described in connection with syphilitic arteritis may also be observed here, apparently as a result of the induration and gummatous infiltration and arterial changes.



Fournier has described a severe delirium such as one sees in typhoid or encephalitis and acute meningitis. Cornil reported a case of an eighteen-year-old youth with a severe delirium, resembling the delirium of an infection, which was ushered in by general convulsions and in three days terminated with a fatal result. The autopsy revealed a pachymeningitis gummosa.

In many cases of chronic specific meningitis of the convexity the chief symptom is a progressive dementia. The condition begins with apathy and lack of interest; the memory becomes poor. Fournier describes an "*amnésie syphilitique*"—the powers of comprehension are weakened and, without either exaltation or depression, a severe dementia develops. Other symptoms may be entirely lacking, except those corresponding to the general decrease in the personal well-being, and a slowness and difficulty in the movements because of this. They become awkward and clumsy, but not parietic and ataxic. The gait likewise becomes heavy, the impulse for lifting up the limbs is lacking, the ability to maintain the equilibrium suffers because of a lack of attention and the patient may sway and totter. In this stage one not infrequently sees the clinical picture which brain-tumor sometimes presents as the only expression of the severe intracranial disease.

This severe clinical picture may, under suitable treatment, disappear.

**A Case of Slow-developing Progressive Dementia, without Somatic Symptoms, Cured by Antispecific Therapy.**—A banker, forty-six years old, sixteen years before his present illness had contracted syphilis. For about six months he found difficulty in doing his work. He also lost his zest for amusement. He began to sleep during the day, and at night slept as if he were dead. He lost interest in his business and family. He did not observe the failure in his mentality, and was astonished because his family thought he was sick. Occasionally he complained of pains in his head and of dizziness. He became gluttonous, untidy in his eating and dress, but at the same time was good-natured and peaceable. He at no time manifested any indication of ideas of grandeur

or periods of excitement. His speech became bad. He left out words, spoke as one to whom it seemed difficult to keep awake; at the same time there was no syllable stumbling and no aphasic disturbance. His gait was heavy.

Objectively there was no arteriosclerosis and nothing to indicate an increase of intracranial pressure. The characteristic somatic symptoms of paresis were absent. After this patient had received antispecific treatment for four weeks he began to improve. Little by little he awakened, became stronger mentally, and more active physically. He has remained perfectly well now for eight years. At my suggestion he has taken a mixed treatment two months out of each year for four years.

**Pupil Anomalies.**—The pupil anomalies are an exceedingly important and frequent symptom. They occur not only as the result of an involvement of the oculomotor nerve-trunk and its nucleus, but also may occur from disease of the cortex.

Recently a series of observations concerning the changes in the size of the pupil in hysteria have made a cortical localization of the movements of the pupil probable. Bechterew and Piltz have demonstrated experimentally that from certain areas of the cortex pupillary changes can be produced. According to our present experience, apart from an abnormal reflex activity, we are not justified in considering anomalies of the pupil as possible in neurasthenia.

The cases of so-called neurasthenia after lues are, excluding chronic alcoholism, if pupil anomalies exist, either in the category of dementia paralytica incipiens, or they are the clinical expression of a specific meningitis, either of the convexity or base of the brain.

The pupillary changes of general paresis do not respond to antispecific therapy.

The importance of the behavior of the pupils in a differential diagnosis of general paresis and specific meningitis of the convexity is illustrated in the following case:

A merchant, thirty-five years old, became infected with syphilis nine years ago. He took one short course of inunc-

tions at the time, another course three years ago, and two years ago a course of potassium iodid. The patient has shown no symptoms of syphilis since he finished his inunction treatment. He has never been a potator. His disposition has changed in the last six months. He becomes irritated very easily, is careless of his personal appearance, and is forgetful. During the past few weeks he forgets to urinate, loses his way on the street, and wants to sleep all the time. He complains occasionally of headache and dizziness. Objectively no demonstrable evidences of syphilis were discovered. His condition indicated apathy and dementia. There existed severe disturbances of his intelligence, memory, and power of orientation.

There was no paralysis of the cranial nerves and no speech disturbances, except that his speech corresponding to his dementia was toneless and indistinct. There were no spinal symptoms and the patellar reflexes were lively.

The pupils were of medium size and equal; reaction both to light and convergence was sluggish. Otherwise the eyes were normal.

A course of inunctions was begun immediately. In four weeks the change in the patient was marvellous. His normal interest and activity returned. He became careful of his personal appearance, clean in his habits, could do small examples without mistake, wrote both the history of his life and the history of his sickness without errors in spelling or composition, and was free from headache and dizziness. By more careful examination, however, numerous defects in his intelligence and memory became apparent.

The pupil anomalies remained exactly the same and the patellar reflexes were still lively.

The diagnosis "remission in a case of general paresis" was made because of the behavior of the pupils. After remaining apparently well for a year, he quickly developed the mental picture of dementia paralytica.

**Combination of Paresis with Specific Meningitis of the Convexity.**—Meningitis of the convexity may also exist in combination with general paresis, with the patient manifesting symptoms of both affections.

A woman, thirty-one years old, who had been treated eight years before for secondary syphilis, became unable to work because of severe attacks of headache preceded by dizziness, and also a left-sided hemiparesis, which had in the main receded but had left behind a condition of physical weakness. She had not been addicted to the use of alcohol. She was received into the hospital because of attacks of unconsciousness.

At the time of her entrance she was in a stuporous condition, showed symptoms of motor aphasia and agraphia, slight paresis of the right side. The pupils reacted somewhat sluggishly, there was no hemianopsia, the eye backgrounds were normal, all the tendon reflexes were lively, right more active than left. The cranium, in the left parietal region, was sensitive to percussion.

Under a mixed treatment the stupor gradually disappeared and a moderate degree of dementia took its place. The patient gradually became brighter; in speaking a paraphasic defect was often manifest. Her severe attacks of headache returned and she developed ideas of grandeur. The dementia gradually deepened, and the epileptic attacks began again, in one of which she died.

The autopsy revealed the dura mater adherent to the skull, and over the frontal region much thickened. The pia over the parietal and temporal regions was cloudy and thickened, adherent in places to the cortex, showing, in part, gummatous infiltrations which had extended to the cortex. The ependyma of the enlarged ventricles was thickened and granulated. The arteries of the base and the arteria fossæ sylvii and arteria profundæ were not altered.

The microscopic examination of the cortex demonstrated the following changes:

First. Marked disappearance of the tangential fibres, thickening and increase of the glia.

Second. Degeneration of varying degrees of the ganglion cells.

Third. Thickening, and in part hyaline degeneration, of the arterioles of the cortex.

In this case the pathology justifies one in regarding



the tenderness to percussion, the attacks of epilepsy, the stuporous condition, and probably the hemiparesis and aphasia as caused by the pachy- and leptomeningitis, and to assume that their partial disappearance was due to the antispecific therapy. As a matter of fact, fresh infiltrations of the meninges existed alongside of old cicatrized thickenings. The psychic changes should be attributed to the dementia paralytica, whose pathology was demonstrated in the changes of the ganglion cells, the disappearance of the tangential fibres, and the proliferation of the glia.

**Choked Discs.**—Choked discs should also be enumerated under the general symptoms. This condition is more apt to occur in a basilar meningitis, but may appear occasionally in a cortical encephalitis gummosa.

**Cortical Convulsions.**—Under cortical convulsions, we understand, of course, according to Jackson's description, a discharge of muscular contractions, tonic convulsions by retained consciousness, or with the consciousness only slightly disturbed. The contractions may be confined either to one extremity, or only a part of the same (as the finger or hand), or they may extend, according to the discharge of the excitant, involving one centre after another, until the upper and lower extremities and the face and tongue become involved.

One can only be positive in diagnosing the source of the convulsion, as existing in the cortex, when paralyzed or paretic parts become involved in the jerkings or spasms. Sometimes, however, the accompanying symptoms will permit of the establishing of a cortical origin for the convulsions without the necessity of there first being a paralysis.

If the syphilitic changes in the meninges are limited, convulsions will be the result when these changes occur over the motor area. When the involvement of the meninges is extensive we not infrequently see the patients affected with general epileptic attacks, which cannot be distinguished from the attacks of idiopathic epilepsy, if in the periods between the attacks, headaches, slight defects in memory, and an insignificant dulling of the mental powers are not

discovered by careful examination, or if intercurrent motor symptoms of irritation—such as tremor, isolated muscle contractions, or even permanent conditions of contracture—are not present.

From our experience with brain tumors we know that from almost any spot in the brain general convulsions may be liberated, so we should not be astonished if a gumma located in the substance of the brain causes an epilepsy, which does not, however, bear the character of a cortical epilepsy.

**Hemipilepsy.**—The hemipilepsy, even in a severe form, does not always present a macroscopic or a microscopic recognizable pathological basis, as Leo Müller has shown from cases in my department at Eppendorf.

Heubner has called attention to the frequency of epileptic convulsions. He observed in 45 cases of gummatous meningitis of the brain convulsions in 26 cases.

The views concerning the frequency of hemipilepsy differ. We find the greatest variation when we compare Charcot's view, who regarded hemipilepsy as of frequent occurrence in syphilis, with Naunyn's experience, who found, out of 105 cases, only a single case of hemipilepsy.

I cannot regard the occurrence of hemipilepsy so rare as does Naunyn. I have seen this form of epilepsy numerous times, both monosymptomatic and in combination with other symptoms.

It may happen that the hemipileptic attacks appear as the first symptom of the disease. However, this is not frequent, much less frequent than in brain tumor. Almost always a more or less severe headache and general symptoms precede the epilepsy.

The cortical convulsions can present every shade of transition, from a typical Jacksonian epilepsy to general epileptic convulsions.

One should remember that in brain syphilis the convulsions represent only a part of a long chain of brain symptoms.

The cortical paralyses may appear as monopareses or monoparalyses, or also as hemipareses or hemiparalyses.

These paralyses may develop either slowly or in an acute manner. The acuteness or chronicity of development is determined by the pathological conditions.

The cortical paralyses may precede the convulsions, may follow them, or may appear without any convulsive symptoms. Cases of isolated cortical motor symptoms, however, are rare. In the great majority of cases, along with the cortical symptoms of convulsions and paralysis, are found basilar meningeal and arteritic symptoms.

The following case is an example of a pure cortical epilepsy without any objective somatic symptoms:

A man, thirty-three years of age, became infected with syphilis in 1891. He had been healthy before, and his family history was good. The initial lesion and secondary symptoms were thoroughly treated. On his return from a trip to New York, after he had complained of headache and dizziness several days before, he was suddenly seized with epileptic convulsions, which were localized on the left side and accompanied by only slight disturbances of consciousness. His objective examination revealed, as the only evidence of a previous lues, a slight indolent swelling of the glands of the neck and inguinal region. He complained of a dull headache and at times of dizziness, also of sensations of numbness and crawling in his left leg, which he did not feel sure of in walking.

The cranial nerves, pupils, and eye backgrounds were normal. An abnormal sensitiveness to percussion was present on the right anterior and middle part of the cranium. Sensation and both skin and tendon reflexes were normal.

Under inunctions and the internal administration of potassium iodid, the headache and dizziness improved. A week after beginning treatment, without any warning, while the patient sat at the table, he was seized with another epileptic attack, in which he became unconscious, with convulsive movements on the left side of the body. Three days after this he had still another attack, where the convulsions were limited to the left side, but in which he did not lose consciousness. This was his last seizure. Three months later he returned to New York, apparently well.

The following case is also one of cortical epilepsy with choked discs:

A plumber, thirty years old, had contracted lues six years before. He had taken no treatment for it. For four weeks he had noticed sensations of creeping and a furry feeling on the left side of his body. One day, without any apparent cause, his left leg was suddenly drawn up with a cramp. The next day this occurred again, and the patient lost consciousness and fell to the ground. His landlady stated that during his unconsciousness he had muscular twitchings in his left side. For about five minutes after his attack he complained of headache, but went to work. The following day he had such a severe headache that he was compelled to quit work. A few days later he was received into the hospital, having had repeated convulsive attacks in his left side. The patient in walking dragged his left leg a little. The tendon reflexes on the left side were increased, the skin reflexes decreased. The skull above the right central convolutions was sensitive, both to pressure and percussion. In the background of the eyes there was a well-marked choked disc. The pulse was slow, between 50 and 60.

Under a mixed treatment all the symptoms gradually disappeared. The choked discs remained the longest.

**General Epilepsy.**—The general epilepsy may be even more frequent than the hemiepilepsy, the first symptom, the forerunner of other cerebral symptoms. It usually appears, however, with general symptoms such as headache, vomiting and dizziness. A woman thirty years old was infected two years ago by her husband. During the past nine months she has complained of a severe headache which at times resembled migraine in character. During the past five weeks she has had three epileptic attacks.

Examination: Right facial paresis; slight motor aphasia; sensitiveness to percussion on the skin over the right and left motor areas, beginning choked discs on both sides.

Wassermann in blood ++. Wassermann in spinal fluid ++ (from 0.4 c.c. up). Pleocytosis +. Phase I ++.

Energetic treatment with inunctions of mercury and



potassium iodid caused all of the symptoms to disappear.

**A Case of Hemiparesis Apoplectica Arteritica.**—A woman, forty-eight years old, was infected by her husband twenty years before. She took at the time a course of inunctions, later aborted several times, gave birth to two dead children, and then two living ones, who soon died. Otherwise she had always been healthy. For four months she had complained of severe headaches, and paræsthesias in the right upper and lower extremities, of dizziness coming on in attacks, and spells of an uncontrollable desire to sleep, alternating with insomnia. Three days before her entrance into the hospital she fell suddenly to the ground and became paralyzed in her right side.

Physical examination revealed a right-sided paralysis of the extremities, with paresis of the right facial, and slight disturbances of consciousness. There were no signs of intracranial pressure. There was present in both eyes a chorioretinitis, which from the ophthalmologic side was regarded as specific. Antispecific treatment was begun immediately. Three days after her reception into the hospital the patient was seized with convulsions on the right side and became unconscious. These attacks were repeated in the course of the next two weeks several times and extended to the left side of the body. These finally gradually disappeared, and after three months' treatment the patient was discharged. A slight paresis still existed in the right upper extremity, and the deep reflexes on this side were more active than on the other side. The chorioretinitis was greatly improved, and the headache had entirely disappeared.

With reference to the etiological rôle of trauma, the following case is interesting:

**Meningitis Convexitatis Luetica Post-traumatica.**—A farmer, fifty-five years old, was seen by me for the first time on March 31, 1899. Eleven weeks before he had fallen from a hay-loft to the floor of his barn and had struck upon his neck and the left side of his head. After about two weeks, when the symptoms of a spinal meningeal hemorrhage had disappeared, the patient seemed fairly well, until six weeks

later, when a headache, which was localized on the left side of the head, made its appearance. The pains increased in severity. The patient had a feeling as if the scalp was too tight, had a constant desire to sleep, and complained of dizziness. His gait was unsteady. He developed a weakness in his right arm, so that he was unable to write; also depression and attacks of fear of impending death. In the last two weeks he experienced involuntary twitchings in the fingers of his right hand. During the last four days he had two convulsive attacks involving the whole right side, beginning in the leg and extending upwards.

His history in regard to lues was somewhat indefinite. While a widower, after having had three children by his first wife, he developed an ulcer of doubtful character, for which he never took any antisyphilitic treatment. Afterwards he married again. His second wife had four successive miscarriages, then, after a course of treatment with mercury and iodid, gave birth to a child, which died one year later, with enlarged glands. While she was carrying the next child the mother took potassium iodid. The child came at full term, and still lives. The next child (during the pregnancy the mother took no treatment) died two weeks after birth with marasmus.

The examination showed tenderness of the left side of the skull to percussion, which seemed most localized over the upper and middle parts of the central convolutions. The entire right side was weak. The powers of localization, position, and astereognosis in the right upper extremity were somewhat lacking. Otherwise no other disturbances could be determined. I prescribed a thorough treatment with mercury and iodid, upon the assumption that, as the result of a head injury in an individual who had previously had syphilis, a localized specific meningeal infection had developed.

The patient took daily, for six weeks, inunctions containing four grammes of mercury and internally three grammes of potassium iodid. During the first fourteen days of the treatment the patient grew worse rather than better. He was much depressed, and seldom spoke, and then it was

difficult for him to think of the words he wished to use. After fourteen days he began to improve slowly, and eventually made a good recovery.

The diagnosis of disease of the meninges may be determined by the cortical nature of the convulsions which take place in the paræsthetic and paretic extremities, by the sensitiveness to percussion over the areas corresponding to the parts affected, and by the character of the sensory disturbance. The specific nature of the disease must, of course, be elicited from the previous history of the case, the examination, and the effect of antispecific therapy.

**General Epileptic Convulsions.**—General epileptic convulsions may be more frequent than hemiepilepsy, the first precursors of other cerebral symptoms. They occur, however, almost always accompanied with the general symptoms of headache, dizziness, and vomiting. Disturbances of and loss of consciousness may not take place, although consciousness is usually affected.

We know that specific disease of the cortex can produce both hemiepilepsy and general epilepsy, but it has further been proven that through syphilis an individual can become epileptic without the development of specific changes in the central nervous system. In other words, an epilepsy of the character of the genuine (not secondary in the sense of Nothnagel's) under the influence of a luetic infection may both appear and remain as monosymptomatic in character. This condition will be further discussed, and cases cited, in the chapter on "Neuroses in Syphilis."

**Sensory Disturbances of a Cortical Origin.**—Sensory disturbances emanating from the cortex are not often observed.

The following is an interesting case of sensory hemiepilepsy:

A merchant, thirty-eight years old, eight years before had acquired syphilis. He consulted his physician because of attacks of unilateral paræsthesias. The crawling sensation and furry feeling began in the face, extended to the upper and then the lower extremities. These paræsthesias were regularly accompanied by dizziness and a partial loss of consciousness. After the attack, which lasted about fif-

teen minutes, the patient complained of headache and a general feeling of weakness. Symptoms of motor irritation never appeared.

**Cortical Speech Disturbances.**—Cortical disturbances of the speech are more frequent. The motor or sensory aphasia can, of course, only be regarded as cortical when cortical symptoms are present.

The aphasia is often only slightly indicated. The patient has difficulty in finding the right expression, or makes paraphasic mistakes. In other cases the aphasic disturbance is only of short duration, coming in an attack and then permanently disappearing, or reappearing in more severe form. When the aphasia persists it is usually accompanied with either symptoms of motor irritation or paralysis in the face and extremities.

**Hemianopsia.**—Hemianopsia can also appear as a symptom of cortical meningeal affection. The best known case is the one of Pooley, although in this case the right-sided hemianopsia and hemiparesis were not entirely derived from the cortex, for the specific growth had penetrated into the brain substance of the left occipital lobe.

**Differential Diagnosis of Meningitis Syphilitica Cerebralis Corticalis.** **Headache from Local Causes.**—Where the headache appears as an isolated symptom, other causes, such as chronic ear and nasal affections, arteriosclerotic changes in the arteries, disease of the kidneys, and tumor or abscess of the brain of non-luetic origin must be excluded.

**Simple Headache.**—One should also remember that a luetic may be affected with a simple headache. In the differential diagnosis of such cases the examination of the spinal fluid with reference to the pleocytosis, globulin, and Wassermann reactions will usually enable one to determine the difference.

**Headache Due to Uræmia.**—If, in a syphilitic patient with headache, albumin is found in the urine, it may be difficult sometimes to decide whether the brain symptoms, headache, vomiting, epileptiform convulsions, and stupor are the expression of a specific brain affection or of a uræmia. Examination of the spinal fluid will in such conditions be



extremely valuable in differentiating between these two conditions.

Syphilis, as is well known, does not cause contracted kidneys. We see the effects of syphilis on the kidneys in the form of a circumscribed interstitial nephritis with and without gummatous formation, as well as amyloid degeneration, most often combined with diffuse chronic parenchymatous disease. This form of kidney affection is particularly frequent in combination with specific disease of the liver.

**Headache with Pachymeningitis Alcoholica.**—In other cases a complicating alcoholism will make it difficult to decide whether the pachymeningitis is due to syphilis or alcohol. Pachymeningitis alcoholica may appear under the general symptoms of a diffuse or localized headache, accompanied at the same time by attacks of stupor and heavy sleep, also by localized convulsions, by hemiepileptic and general epileptic attacks, and by paresis and paralytic conditions of the extremities.

**Tumor Cerebri.**—True cortical convulsions do not always have a visible or palpable pathological basis, which naturally should cause one to be rather cautious in the diagnostic utilization of cortical epileptic convulsions, even in syphilis. On the other hand, we know that disease of the cortex may appear under the clinical picture of general epileptic convulsions, while tumors and softenings situated in other portions of the brain, and which, except reflexly, have nothing to do with the cortex, can cause cortical convulsions.

Case of tumor in the motor centres of the cortex with general convulsions:

A woman, forty years old, had married a syphilitic husband, who later died of brain syphilis. After several abortions she gave birth to normal children. Three months before her death she began to complain of headache. Then one day she was suddenly seized with general epileptic convulsions, severe in character, followed by headache and vomiting. In addition to these symptoms she had attacks of disturbed consciousness, alternating with complete clearness. The patient died in a severe epileptic attack.

Physical examination four days before death revealed a slight motor weakness of the right side of the body with increase of the tendon reflexes, sensitiveness to percussion of the entire skull, on the left side more marked than on the right, and choked disc on both sides.

The autopsy revealed a soft glioma in the left posterior central convolution, which extended into the substance of the brain.

Until recently there were many cases where it was impossible to make a differential diagnosis between a non-specific tumor and a specific inflammatory process. At the present time, with the aid of the four reactions, this may be done.

Variation in the clinical picture is more apt to be found where gummatous infiltration exists than where there is a true gummatous tumor. However, one should remember that a non-specific tumor can likewise cause considerable variation in its symptoms when its growth is slow, so that the surrounding nerve tissue has time to adjust itself to the changing conditions, or through rapidly occurring retrograde metamorphosis, which also may take place in non-specific growths, or by hemorrhages which quickly or slowly change the character of the new growth.

**Brain Abscess.**—What has been said in regard to the differential diagnosis of brain tumors applies also to brain abscess. In brain abscess, however, another factor is to be considered. One should never diagnose a brain abscess unless an adequate etiological cause exists, such as a primary collection of pus somewhere in the body, as occurs in disease of the ear and nose or after a head injury.

In this connection the following case is of interest:

A blacksmith, forty-two years old, had acquired lues ten years before, and sixteen years before had had an ear abscess. He was taken sick with general apathy, headache, a right-sided paresis, and the gradual development of a double optic neuritis. Mixed treatment did him no good. A slight disturbance of co-ordination of the trunk musculature, together with a left-sided anosmia, indicated involvement of the frontal lobes. The ears were normal.

The autopsy revealed a large encapsulated chronic abscess in the left frontal brain and an old osteomyelitis of the petrous portion of the temporal bone on the left side.

**Specific Arteritis.**—Whether or not the irritation and paralytic symptoms depend upon the non-specific effects of specific arterial disease is often difficult to determine, because thrombosis of the basal arteries, and the resultant anæmia thus produced in the corresponding brain areas, may cause symptoms of motor irritation. In many cases a marked sensitiveness to percussion of the skull, and the cortical character of the irritative manifestations, speak in favor of a meningeal affection. One should not forget, however, that frequently both forms of specific brain-disease, the arteritic and meningitis of the convexity, exist at the same time.

**Paresis.**—In connection with the diffuse form of meningitis of the convexity, which occurs without localizing symptoms, and not infrequently either slowly or rapidly runs the course of a progressive dementia, in addition to alcoholism, the dementia form of general paresis must be considered.

In chronic alcoholism one often finds a slight persistent dementia with myosis and sluggish reaction of the pupils. A clear-cut and permanent loss of the pupil reflexes would argue strongly in favor of paresis.

Both Mendel and Kraft Ebbing have called our attention to the fact that in the simple dementia type of paresis anomalies of the pupil may not appear until late in the disease, while, on the other hand, diffuse cortical brain lues may early cause pupillary changes, which renders a differential diagnosis still more difficult.

**Cerebral Arteriosclerosis.**—If the patient has attained the age of arteriosclerosis, not infrequently it is hard to decide whether a diffuse arteriosclerosis, cortical degeneration, or a diffuse specific disturbance of the convexity exists. A palpable arteriosclerosis or the evidence of this disease in the heart does not prove its existence in the cerebral arteries, for we know arteriosclerosis may appear as an entirely localized affection. We also know that the arteriosclerosis

of old age, to be sure rarely, can cause epileptic attacks of a purely Jacksonian character, and even the development of a status hemi-epilepticus.

**Tuberculosis.**—Tuberculosis on the brain convexity must also be considered in a differential diagnosis. We know that this affection frequently begins with transient aphasia, cortical irritation and symptoms of paralysis; that incomplete paresis can occur, and that general symptoms in the form of headache, nausea vomiting, vertigo, and psychic disturbances may precede the local symptoms, and that comparatively long remissions may also take place here as well as in specific disease.

In such cases the general habitus of the patient, also the presence, on the one hand, of demonstrable tuberculosis, and, on the other, of present or past syphilis, the rapid and unfavorable course in the tubercular affection and the effect of the therapy, will enable one to make the differential diagnosis.



## V

### SPECIFIC BASILAR MENINGITIS

SYPHILIS of the brain-base is more frequent than of the convexity. The base of the brain is the favorite localization for lues when it attacks the nervous system. When we also consider the frequency of tuberculosis on the brain-base we must come to the conclusion that this region of the brain offers a favorable soil for the development of the germs of disease. Rumpf considers that the blood-vessels entering into and going out of the brain in this position, together with the lymph-channels, produce for the growth of microbes particularly suitable conditions. He also calls attention to the wide gaps in the arachnoid at the side of sella turcica and the optic chiasm, as well as in the region of the lamina perforata anterior, as points of easier access to germ invasion.

The general symptoms are the same as occur in every chronic and subacute organic brain disease, and have been enumerated in the description of the clinical symptoms of specific arteritis, and meningitis on the convexity.

**Clinical Symptoms.**—Headache is almost always present, and may be especially severe. It is most frequently accompanied by a feeling of severe pain, deep in the orbits of the eye. The sensitiveness to percussion is often localized upon the forehead and over the eyebrows.

Vomiting and vertigo are also of frequent occurrence.

Optic neuritis and choked discs occur more often in the basal type than in any of the other forms of meningitis, and may be regarded as evidence of a lesion of the optic nerve in some part of its course.

**Psychic Disturbances.**—Psychic disturbances manifest themselves in basilar lues, most often as stupor, or as more or less severe conditions of excitement. Well-developed psychoses, whether in the form of paranoia or as melancholia or mania, must be considered as combinations.

**Temperature.**—The temperature, as a rule, does not rise above the normal. Oppenheim, after a review of the literature of this subject, came to the conclusion that slight temperature variations of atypical character occur not infrequently, but that the presence of a high temperature would indicate a complication. Quinke reports two cases with long-continued subnormal temperature.

**Polyuria and Polydipsia.**—Polyuria and polydipsia, as in brain tumor and after brain injury, occur in brain syphilis. Our present pathological teachings do not bear out our previous ideas, that these symptoms are indicative of an involvement of the medulla or its proximity. We only know that polyuria and polydipsia can occur by such involvement, but that both of these symptoms are most frequently met with in cases which must be regarded as diffuse basilar meningitis.

**The Cranial Nerves.**—The cranial nerves may be individually attacked, and also only on one side. This is rare, however. The rule is that several cranial nerves situated anatomically in close relationship are involved in the diseased process, and that both sides of the base, as in tuberculosis, are affected.

**Involvement of the Olfactory Nerve.**—Cases are reported in the literature of an affection of the olfactory nerve where the sense of smell was either diminished or destroyed. Such cases would, in all probability, be more frequently noted if the sense of smell was tested oftener. In one case in which the clinical diagnosis was made of tumor in the frontal lobes the autopsy showed a gummatous growth and a chronic gummatous meningitis on the base of the right frontal lobe. Right-sided anosmia was demonstrated in this case.

Cases of anosmia have been reported from simply increased pressure inside the cranium.

**The Optic Nerve.**—The optic nerve may be either primarily or secondarily affected. Secondary affection is the most frequent.

By primary involvement we understand that the nerve substance itself, without any extension from the meninges,

is attacked either by gummata or Heubner's arteritis. By far the most frequent points of involvement in the optic tract are the optic nerve and the optic chiasm.

The optic nerve is more often secondarily affected than

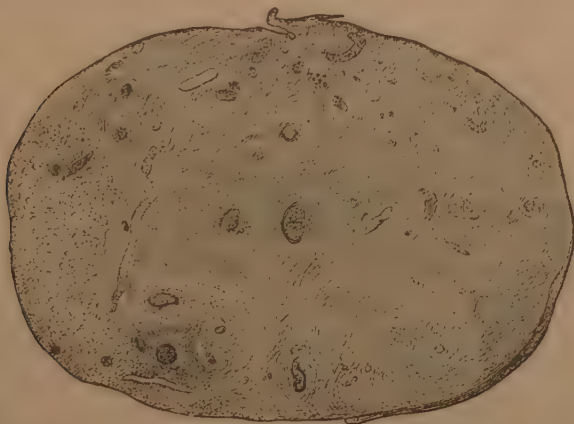


FIG. 30.—Transverse section through a complete gummatus degeneration, and greatly thickened trunk of the oculomotorius. Very few fibres are preserved.

primarily. It may be compressed through gummatus proliferations, or suffer by an infiltrating meningitis. It happens not infrequently that the gummatus inflammation penetrates in between the nerve-fibres and causes an inter-



FIG. 31.—Transverse section through the base of the brain just in front of the optic chiasm. The intracranial optic trunks are partially atrophied and entirely enveloped in gummatus proliferations. Syphilitic endarteritis. (Unthoff.)

stitial syphilitic neuritis which in itself produces a secondary atrophy of the optic nerve-fibres.

The optic nerve can almost entirely degenerate as in the above cut (Fig. 30) taken from Unthoff, or the nerve-

fibres themselves may become infected through an extension of the inflammation from the meninges, which leads indirectly to primary parenchymatous degeneration.

Disease of the optic tract from the bulb to the primary optic ganglion manifests itself first through ophthalmoscopic changes and second through disturbances of the vision. The ophthalmoscopic changes consist in optic neuritis and choked disc. We have seen that choked disc comes

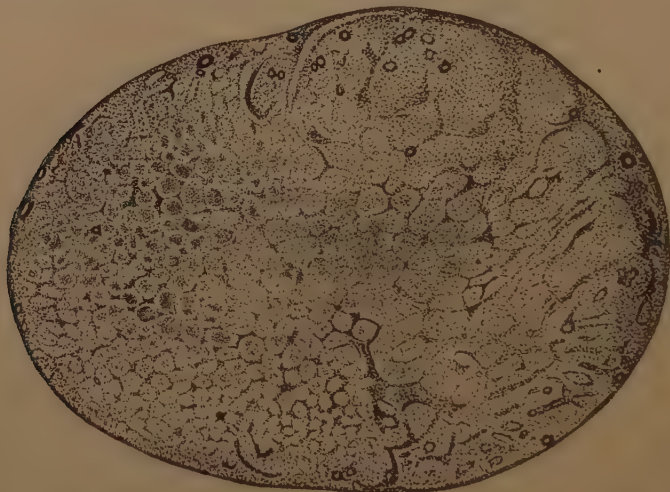


FIG. 32.—Transverse section through the intracranial optic trunk, perineuritis and neuritis gummosa.

occasionally in gummatous meningitis of the convexity. It is oftener encountered, however, in gummatous basilar meningitis.

In a differential consideration one must keep in mind the frequency of choked discs in brain tumor, also, though less frequent, its occurrence in apoplexy, brain abscess, albuminuria, diabetes, and, in exceptional instances, in leukaemia.

**Ophthalmoscopic Changes in Choked Disc.**—In a true choked disc one finds a precipitous swelling of the head of the optic nerve, the blood-vessels are tortuous, the veins are dilated, and the arteries contracted.

Usually hemorrhages of varying degree are found in the retina, in later stages also not infrequently whitish or yel-



lowish areas of degeneration occur very similar to those found in Bright's disease.

The condition of choked disc may entirely recede, the papilla again becoming normal, or it may end in the white atrophy of the papilla.

**Explanation of Choked Disc.**—The explanation of Manz in regard to the origin of choked disc is the one accepted at the present time. This explanation has since been confirmed by the recent pathological studies of Saenger and Bier. This is that the fluid from the subdural and subpial spaces of the brain penetrates into the corresponding spaces of the optic nerve, and thus directly compresses the intra-ocular end of the nerve.

**Optic Neuritis.**—In syphilis of the optic nerve conditions are present for both a pure mechanical compression and an interstitial and parenchymatous inflammation. In practice one finds even in brain tumors frequently a combination of pure choked disc and inflammatory symptoms.

In the combination of choked disc and optic neuritis we see the papilla swollen, its contour indistinct. It is hyperæmic, and in color varying only a little from the surrounding retina.

**Neuritis Descendens.**—The swelling of the papilla and the congestion in the veins are insignificant in character. On the other hand, a cloudiness and swelling of the tissue, which extends far over the retina, is present, showing frequently hemorrhages and white plaques, which are apt to be more numerous in the region of the macula lutea, as is seen in retinitis albuminuria. The weight of opinion attributes the neuritis descendens to an inflammatory process which either primarily affects the nerve substance itself or extends from the surrounding tissue to the sheath of the nerve, finally involving the nerve.

To this last category belongs especially meningitis with secondary perineuritis and neuritis.

**Combination of Different Ophthalmoscopic Changes.**—On the other hand, the lymph which, through pressure, has been forced into the sheath of the optic nerve can act upon the axis cylinder as an exciter of inflammation. We then have

the double symptoms of choked disc and the inflammation of the nerve-fibres which extend out of the retina.

**Disturbances of Vision.**—We know from experience that a very high degree of choked disc may exist without any disturbances of the vision whatever, and only when partial atrophy occurs do we observe a greater or less impairment of the field of vision, both centrally and on the periphery. When an antispecific therapy is quickly instituted simple choked disc, as well as pressure neuritis, comparatively soon disappears, and one then saves for his patient the vision, which, when processes of degeneration have developed in the terminal distribution of the nerve-fibres, must always remain greatly impaired.

Case of compression neuritis of the papilla in meningitis basalis luetica with prompt response to antispecific therapy:

A man, thirty-five years old, was received in the hospital December 5, 1898. He had acquired lues in 1894. For about one-half year his memory had been getting weaker; now and then he had attacks of dizziness, which, however, had not developed into unconsciousness. For two weeks he had suffered with disturbances of vision in both eyes. Objectively a bilateral, well-marked compression neuritis was found, more severe on the right side than on the left. The patient was slightly stuporous. He complained of severe headache. The pulse was retarded to 50 or 60 beats per minute. His temperature was subnormal. Other objective symptoms were double patellar and ankle clonus. The skull was sensitive to percussion, especially on the right side. In walking the patient staggered toward the left. The left facial was slightly paretic.

Four days after the beginning of antisyphilitic treatment the patient showed remarkable improvement. In three weeks he was in very good condition. His gait was normal, his sight fairly good, his mental condition appeared normal and the neuritis optica had almost entirely disappeared.

**Form of Visual Disturbance.**—In the uncomplicated cases of neuritis descendens as a sequence to a neuritis or perineuritis localized in the optic nerve the disturbance of vision

bears a distinct character. Both central and peripheral vision suffers. Alexander states that in perineuritis central vision is first and most affected because the fibres which lie in the periphery of the optic trunk have for their destination the macula lutea, the point of sharpest vision, and naturally they, from their location, would suffer first.

On the other hand, in primary parenchymatous disease of the optic nerve the central parts are first and most severely affected, and those fibres are distributed on the periphery of the retina, and furnish the peripheral vision.

**In Marked Disease of the Optic Nerve Some Vision is Usually Retained.**—It lies in the nature of gummatous processes that the entire cross section of the optic nerve is not uniformly affected, and as a result of this, even in unfavorable cases, complete blindness does not often occur, but portions of the field of vision remain preserved.

**Irregularities in Field of Vision.**—As a matter of fact, we find in practice all possible forms of limitation of the field of vision, both of peripheral and central scotomas, confirming here as elsewhere the variability and irregularity of symptoms of syphilis of the nervous system.

**Atrophy of the Optic Nerve with Double Neuritis.**—A woman, sixty-three years old, became infected with syphilis at the age of twenty-four. Ten years before her first visit to me she suffered with severe pains in the head and became blind. At this time she received no treatment. In the course of about two months some power of vision returned to the left eye. Four weeks before she came to me she again became affected with severe headache and dizzy attacks, frequently accompanied by vomiting.

The objective examination showed in the eye background, on both sides, the picture of an atrophy consequent upon a descending retrobulbar neuritis, less advanced on the left side. On the right side the patient was only able to distinguish between light and dark, on the left side she was able with difficulty to count the fingers at a distance of four metres.

Mixed treatment was begun right away. In about one week the headache and dizziness had diminished in inten-

sity. Some days the patient was almost entirely blind; on others she seemed to be able to see fairly well. In three weeks the headaches and dizziness had disappeared and the sight in the left eye returned to about what it had been previous to this attack. A year later she was still in the same condition.

This case is interesting for several reasons. First: It shows that without specific treatment the course of the optic affection was an unfavorable one. Second: That the disease in both eyes did not run a uniform course, but that the process in the left eye became quiescent before the vision was severely impaired. Third: That the patient, in her sixty-third year, thirty-nine years after her infection, still manifested symptoms of an acute syphilis.

This case also demonstrates the transient character of the disturbances of vision, likewise the varying circulatory disturbances in the much-diseased arteries of the optic nerve. Heubner's arteritis would best explain the changing clinical symptoms with reference to the vision.

**Ophthalmoscopic and Perimetrical Examination Necessary.**—Both an ophthalmoscopic and perimetrical examination is necessary in order not to overlook beginning disease of the optic nerve.

In those cases in which the neuritis is localized higher up in the nerve-fibres, and the descending neuritis has not yet reached the head of the nerve, one will not be able with the ophthalmoscope to discover any evidence of the nerve involvement. It is only when the field of vision is taken that the beginning disease is discovered. Attention has already been directed to the fact that a well-marked choked disc may exist without any disturbance of sight.

**The Spinal Form of Optic Atrophy in Tabes.**—The spinal form of optic atrophy is almost always an accompanying symptom of tabes dorsalis, which not infrequently may remain for a long time as an isolated symptom of the disease. Whenever one encounters a primary optic atrophy, tabes should always be thought of, and in the majority of cases other symptoms will be discovered which make secure the diagnosis. Even in those cases where there are no



evidences of degeneration of the posterior columns of any kind whatever one may still feel justified in the assumption of a beginning tabes. The following case is of this nature:

In this case a merchant, forty-eight years old, twelve years after his infection with syphilis, was stricken with an arteritic hemiplegia. During the past three years he has been afflicted with a primary optic atrophy, commencing first on the right side and then involving the left side, and progressive in character.

After repeated and thorough examinations no other symptoms of tabes or paresis were discoverable.

A second case is important because it seems to prove that there may actually be a primary optic atrophy of a true degenerative type in syphilis.

A man, fifty-eight years old, acquired syphilis. His primary and secondary symptoms were both energetically treated. Four years after his infection an optic atrophy, first of the right and then of the left side, set in. The atrophy progressed slowly over a period of six years, and the patient became almost entirely blind. Death occurred suddenly with symptoms of arteriosclerosis of the heart. I had the opportunity of observing this patient repeatedly, and never discovered any other somatic symptoms from either the brain or spinal cord. The autopsy showed (microscopically examined) gray atrophy of the optic nerve of the true degenerative type.

The brain and spinal cord were entirely free from any further evidence of disease, both macroscopically and microscopically.

The patient had an arteriosclerosis of the coronary arteries.

The question whether a non-tabetic and isolated primary optic atrophy, of the character of a spinal atrophy, occurs without syphilis has not yet been determined.

As experienced ophthalmologists claim, and as I have seen in two cases in my own experience, there seem to occur occasionally, spontaneously, cases of isolated optic atrophy which do not develop later into tabes, paresis, or multiple sclerosis.

I am able to report two cases, one in a gentleman, fifty-four years old, and the other in a lady, forty-four years old, who for ten and eleven years respectively have been blind because of a primary atrophy of the optic nerve, and in whom no etiological factor, either of intoxication or infection, could be demonstrated.

The examination of such cases, however, as these at the present time must be regarded as incomplete, if we are unable to state the results of the four reactions in them.

In so far as the result is concerned it is, of course, all the same whether the optic nerve is compressed by a tumor or an indurated and thickened meningeal mass. The effect will be either that of congestion or of atrophy. The diagnosis of a specific affection must be made from the history and other symptoms in the case, and especially from the information gained by the four reactions.

**Influence of Treatment.**—The treatment of choked disc by mercury may show improvement in other cases than those of syphilitic origin. On the other hand, there are many cases of specific disease of the optic nerve which, in spite of energetic and thorough treatment, terminate in an unfavorable result,—that is, severe disturbances of vision.

The following case is an illustration of the benefit sometimes obtained by mercurial treatment in cases of non-specific origin:

A coachman, twenty years old, was thoroughly examined by me, both as to history and physically, without my being able to find the slightest evidence of any past or present syphilis. Two weeks before coming to the hospital he began with headache and vomiting, which was quickly followed by a paralysis in the left upper extremity and a weakness of the left face musculature. There were also well-developed choked discs, tenderness to percussion on the right side of the skull, the intelligence was slightly dulled, the pulse retarded, and occasionally vomiting. In the course of the next ten days, after the patient's admittance to the hospital, the paresis deepened into a paralysis, the left leg became first paretic and then paralytic, and a complete loss of sensation for all qualities appeared in the

entire left side of the body. The behavior of the skin and tendon reflexes was characteristic of an organic brain affection.

I felt no doubt of the diagnosis of a brain tumor of a gliosarcomatous nature, which, beginning in the frontal bone, was growing posteriorly and gradually involving the central ganglia and the internal capsule. When the symptoms reached the intensity above described I ordered inunctions and potassium iodid, and experienced a surprise, as all the symptoms gradually began to disappear after the fourth inunction. After four weeks the only evidences remaining of the former symptoms were a slight tenderness of the left upper extremity, with slightly increased tendon and diminished skin reflexes on the same side. The choked disc had disappeared.

**Pseudo-brain Tumors.**—I saw this case eight years ago, in the beginning of my observations concerning the so-called “pseudo-brain tumors.” Since then I have had an opportunity to observe fourteen such cases, which presented the clinical picture of either a tumor of the cerebellum, or of the motor centres, or of the cerebellopontile angle, and either receded to a normal condition or terminated in recovery with defect, or finally caused the death of the patient, without the autopsy either macroscopically or microscopically revealing any lesion.

Saenger, a number of years ago, described a series of cases in which the symptoms of brain tumor existed, where inunctions had produced a surprising and partial improvement in the symptoms. Later the autopsy in these cases showed no traces of any syphilitic growth.

More frequent, however, than the cases of “pseudo-tumor cerebri” are the cases beginning with vomiting and headache, which develop into a neuritis of the optic nerve of the choked-disc character and, under the administration of mercury, recover without any trace of lues as the etiological factor whatever.

I have observed two such cases during the past year. Both cases were those of young girls. in whom, by the most searching examination, not the least suspicion of syphilis

could be obtained. In both cases, during the administration of an inunction cure, the stasis neuritis disappeared, in one case ending in complete recovery, in the other a partial atrophy.

**Changes in the Visual Power.**—Variation in the power of vision may also occur in brain tumors as well as in gummatous meningitis. Hirschberg cites cases of brain tumor in which the field of vision half-hourly and hourly narrowed and widened. A transient blindness appearing in attacks and quickly disappearing, which has been called epileptic amaurosis (Jackson), is, according to Hirschberg, a fairly regular accompanying symptom of brain-tumor, for which one must search carefully because of its fleeting character.

While we find the cause of the variation in the power of vision in a recurring anæmia of the sight centres due to a transient increase in the brain pressure, we see the explanation of the more frequent and more intensive appearing alterations in vision in specific disease of the optic nerve, either in a change of pressure on the part of the compressing growth, or in the more quickly terminating biological conditions of syphilitic granulation tissue, or, finally, in the varying behavior of the lumen of the affected arteries of the nerve itself.

That the optic nerve is very sensitive to anæmia is well known, and especially has our experience with amaurosis in severe hemorrhages taught us this. This sensitiveness of the fibres of the optic nerve and their end processes is the more serious because of the fact that each branch of the retinal artery is an end artery.

**Oscillation of Sight in a Sarcoma of the Pia Sheath of the Optic Nerve.**—In a case of extensive sarcomatous growth of the pia mater of the entire central nervous system the patient, a seventeen-year-old girl, manifested an intense variation in her power of vision. Finally the sight was entirely destroyed. One could demonstrate, ophthalmoscopically, an extreme anæmia of both papillæ. A later microscopic examination of the optic nerve showed that the tumor masses which had proliferated into the pia had greatly



compressed, in places causing a complete shutting off of the lumen in the blood-vessels in the optic trunk.

**Uhthoff's Experience Concerning Disease of the Optic Nerve in Brain Syphilis.**—Naturally the experience of the neurologist in syphilis of the optic nerve and eye musculature would tend to be much less than that of the ophthalmologist. The co-operative work of Uhthoff on the one hand, and of Oppenheim and Siemerling on the other, has accomplished much in the field of syphilitic optic disturbances.

Uhthoff, from cases of brain lues in the Charité in Berlin, found that only 15 per cent. of the cases were entirely free from eye affections. In the cases observed by him at the autopsy the great variation in the pathological changes is well illustrated.

In the first case, perineuritis, cellular infiltration of the optic nerves, proliferation and new growth from the blood-vessels in the optic sheath, cell proliferation into the walls of the arteries themselves, and penetrating even into the interior of the optic nerve, were found.

In a second case there was a primary gummatous neuritis of the optic trunks and specific disease of the vessels in the nerves.

In a third case there were neuritis and perineuritis interstitialis and the partial transformation of the optic tract into a gummatous mass.

In the fourth case disease of the optic nerve was an accompanying symptom in a gummatous encephalomeningitis of both frontal lobes.

In typical cases reported by Siemerling and Oppenheim there were also a gummatous neuritis and perineuritis of the other nerves on the base of the brain, gummatous infiltration or gummatous tumor in the neighborhood of the basal nerve tracts and in the brain ganglia; gummata were also found in other portions of the brain, as the temporal lobes. At the same time, in many cases more or less extensive specific lesions of the blood-vessels and processes of softening in the region of the basic ganglia and the internal capsule were observed.

It has also been discovered that tabes as a non-specific

process may be combined with a genuine specific affection of the optic nerve (Nonne), and that a syphilis localized in the spinal cord can be associated withlueticaffectations of the eye, and particularly of the optic nerves.

Uhthoff, in seventeen autopsies, found an involvement of the optic nerve in fourteen cases. In 100 clinical cases of his own, in twenty the optic nerve was the only involvement. He classifies the clinical symptoms of the optic apparatus into two groups: first, the ophthalmoscopic findings, and, second, the various visual disturbances.

Among 100 clinical cases of brain syphilis observed by him, he found double typical choked disc four times, neuritis optica eight times, optic atrophy once. From 150 cases collected from the literature of cerebral syphilis, he found choked disc fifteen times, neuritis optica seven times, and simple atrophy ten times. It should also be pointed out here that Uhthoff in five cases of disease of the optic nerve, centrally localized, was not able to demonstrate any evidence of an affection of the nerve ophthalmoscopically.

These cases illustrate what has already been pointed out, namely, the necessity in any case of a testing of the vision of the eye in addition to the ophthalmoscopic examination.

In Uhthoff's material the pathological basis for the choked disc was found in hydrops of the sheath of the optic nerve, with perineuritic changes in the space between the sheath and the nerve, in encephalomeningitis, and also in gummatous proliferations in this space.

**Choked Disc.**—Only in one case of Uhthoff's was the choked disc limited to one side. In all others it was bilateral. It was also his experience that choked disc in brain syphilis can entirely disappear without leaving behind any disturbances of function worth mentioning.

In one case in which a high degree of choked disc had appeared for the second time, one side cleared up completely, while the other went on to simple atrophy and total loss of vision. Now and then choked disc may remain for a long time the only symptom of brain lues. It also happens that brain syphilis, after the neuritis optica has

caused a more or less severe disturbance of the function of sight, becomes quiescent.

**Optic Neuritis.**—Uthoff found from his own material neuritis optica without choked disc in 12 per cent. of the cases, from 150 cases in the literature in 6 per cent. The neuritis was caused in these cases by perineuritic changes of the orbital optic trunks, basilar gummatous meningitis, and specific tumor formation. Hutchinson reports specific disease of the optic nerves in one case.

**Optic Atrophy.**—Simple optic atrophy occurred in Uthoff's 100 cases fourteen times, in four of which the atrophy was complete, in the others only partial. In the 150 cases taken from the literature, atrophy occurred ten times.

**Visual Disturbances.**—In regard to the disturbances of vision, from Uthoff's statistics and a review of the literature one learns that they may develop either quickly or slowly, that they are usually incomplete, and that they show a variation in their course, often are one-sided, and that the field of vision is of different types. Uthoff saw, in his large experience, a double-sided complete and permanent blindness only once, twice a transient complete blindness on both sides, and seven times a complete and permanent blindness of one eye.

Brain lues, in contradistinction to tumor cerebri and the different forms of non-specific cerebral meningitis and hydrocephalus, causes total loss of vision only in rare instances.

**Chiasm and Optic Tract.**—The optic tract and the optic chiasm are affected by luetic processes still more often than the optic nerves. The optic chiasm is usually primarily affected, and from there as a starting point the specific process advances either backward along the optic tract or forward to the optic nerves. Disease of the chiasm in addition to the ophthalmoscopic changes may be recognized by the hemianoptic visual disturbances. From the assumption of a partial crossing of the optic fibres in the chiasm as a fact, bitemporal and binasal hemianopsia are explained when the anterior or posterior angle of the chiasm is

affected, and homonymous hemianopsia occurs if the optic tracts are involved. One can readily understand that practically all sorts of complications and transitions occur. As an example, if one branch of the optic tract is diseased, and from this point there is an extension of the affection to the chiasm, in addition to a homonymous hemianopsia a progressive disturbance of vision must develop for the other half of the field of vision.

Only very rarely are hemianoptic disturbances caused by a shutting off of the blood-supply to the basal part of the optic conduction apparatus.

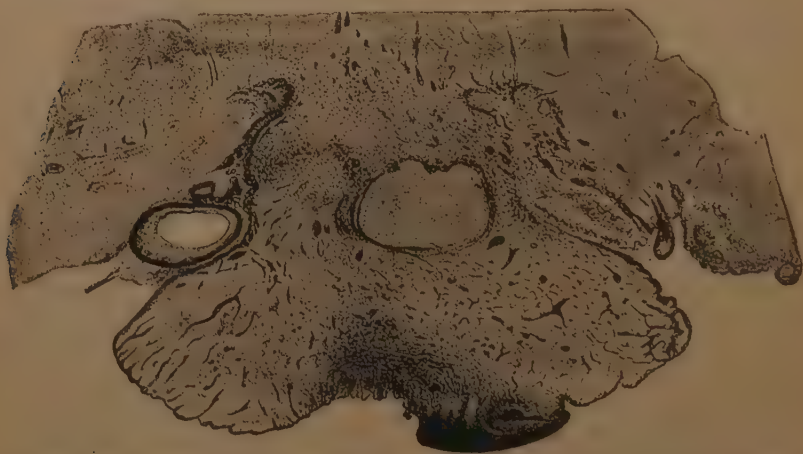


FIG. 33.—Cross section of the chiasm not far from the anterior angle, gummatous proliferations, endarteritis. (Oppenheim.)

One may conclude, if the visual defect starts as hemianopsia, the pathological process has begun either in the chiasm or in the tracts; on the other hand, if the visual defect begins as purely one-sided, the process has had its beginning in the optic nerve on one side or the other, and from this point extended to the chiasm. Uhthoff estimates that 10 per cent. of all cases of homonymous hemianopsia and 15 per cent. of all cases of bitemporal hemianopsia are of specific origin.

Homonymous hemianopsia is more frequent than heteronymous.

Uhthoff from his material found the homonymous



hemianopsia eleven times and the bitemporal form of the heteronymous type six times. In all of his cases he did not observe a single case of the binasal type, and from the 150 cases in the literature only one case was reported. Concentric narrowing of the visual field he observed five times.

**Oscillating Hemianopsia.**—Oppenheim has described an oscillating form of hemianopsia or hemianopsia fugax as characteristic in basilar brain lues. He has observed three such cases. In a period varying from two days to two weeks the area of the bitemporal visual field changed quickly, enlarging and diminishing.

In the following case the type of the visual field permitted the localization of the process to the chiasm; also a right-sided facial paralysis indicated a lesion on the base.

**Basal Bitemporal Hemianopsia, Descending Neuritic Atrophy on One Side.**—A man, forty-six years old, who twelve years before had acquired syphilis, was taken without any apparent cause with a feeling of pressure and heaviness over both eyes. He did not have any headache, vomiting, or dizziness. Two weeks later he observed a shadow on the right side of the right eye. The sight of the right eye gradually diminished. Examination demonstrated that in the right eye the patient was hardly able to distinguish the light, the right pupil was smaller than the left and did not react to the light, while the consensual and convergence reactions were present. The right papilla was only a little paler than the left. The left pupil reacted normally and the vision in it was normal. There was no paralysis of the eye muscles on either side.

Examination of the field of vision revealed an almost total amaurosis of the right eye; in the left eye almost half of the field of vision on the temporal side was affected.

As the result of antispecific treatment, after five months an examination of the field of vision demonstrated in the left eye still a slight defect in the external upper quadrant; in the right eye the visual disturbance involved the entire temporal half of the field of vision and the upper half of the field of vision on the nasal side.

Eleven months later I saw this patient again. Four months before he had developed a maniacal condition, which afterward changed to severe depression. Objectively the patient was much depressed. Both pupils were somewhat dilated and the reaction to light was a little weaker on the right side than on the left. With the consensual reflex the reverse was true. The right eye was amaurotic and the ophthalmoscope showed a total optic atrophy. The right facial was paralyzed in all its branches. The skull was moderately sensitive to percussion.

The patient did not react this time to treatment, the depression remained, and two months later he died of pneumonia.

**Basal Homonymous Left-sided Hemianopsia, Together with Abducens Paralysis on the Right Side.**—This patient, a woman, twenty-seven years old, I saw first on December 17, 1893. She had been infected with syphilis about eight months before, and had taken a course of inunctions. Two weeks before I saw her she was seized with severe headache which made her stupid, and was most intense over the eyes. For two days she had double vision and had a feeling as of a mist or veil before her eyes.

A rather marked tenderness to percussion was present over the entire cranium, most marked, however, over the forehead and above the eyes. The right abducens was paretic; the remaining eye muscles, including the pupillary, functionated normally.

In the background of the eye one could demonstrate a moderate degree of congestion-neuritis on both sides.

The perimetric examination revealed a large left-sided hemianoptic defect. After six weeks of treatment the patient left the hospital. A small hemianoptic defect of the field of vision still existed. The optic neuritis had disappeared.

**Hemiopic Reaction of the Pupils.**—A symptom for the localization of an affection in one or the other of the optic tracts has been recognized since Wernicke, in 1883, directed our attention to the hemiopic reaction of the pupils. The symptom of Wernicke may be explained in this way: Hemi-

opic reactions are obtained if the reaction to light of both pupils remains unimpaired when both halves of the retina, which are light-sensitive, are illuminated; on the other hand, the reaction is lost when the light strikes the halves of the retina from which the vision is lost. Leyden was the first, in 1892, to confirm Wernicke's teaching by the report of a pertinent case with autopsy. Oppenheim acknowledges in his book on neurology the truth of Wernicke's theory, but emphasizes the fact that in practice proof of the 'hemiopic loss of the reaction of the pupils to light in convincing clearness is rarely obtained.

The following is the report of a case of hemiopic loss of the light reflexes which, together with other symptoms, enabled me to correctly diagnose a specific affection of the optic tract.

**Hemianopsia, Hemianoptic Pupil Reaction, Basal Paralysis of the Eye Musculature, and Epilepsy.**—A laborer, forty-three years old, was under my observation in the hospital four different times. Six years before his first entrance into the hospital, which was January 21, 1896, he had contracted syphilis. About a year before he came into the hospital he became affected with a severe headache and noticed that his power of vision suffered in this manner. It was difficult for him to recognize objects on his left.

At the first examination a paresis of the left rectus internus, a left facial paresis peripheral in character, and diminished capacity for smell on the left side were found. The pulse was 60. Ophthalmoscopically there was nothing definite to determine; on the other hand, the examination of the visual fields demonstrated a left-sided hemianoptic defect.

Under treatment all the symptoms disappeared with the exception of the visual defect. Six months later the patient was again received into the hospital because he had such a severe headache, the visual disturbance on the left side had increased, and he also had convulsive attacks. The convulsions were epileptic in nature, occurred both by day and night, and were accompanied with biting of the tongue, the passing of urine, and left behind them amnesia.

Objectively there was a total hemianopsia sinistra; the temporal half of the left papilla was paler than the nasal half. When one carefully (in a dark room) allowed the light to fall on the temporal half of the right and nasal half of the left papilla, no light reaction could be obtained, while the reaction promptly occurred when the other retinal halves were stimulated with the light.

Antisymphilitic treatment of three months' duration did not show any results.

At a third entrance into the hospital the objective examination was the same.

A year later the patient was again taken into the hospital because of a left-sided hemiparesis which suddenly developed like an apoplexy. The paresis, under antispecific treatment, almost entirely disappeared. The ophthalmoscopic examination was the same as before. The hemianoptic loss of the pupillary reflexes to light could also be demonstrated.

It is proper to call attention here to the rapid increase of cases of neuritis optica and of paralysis of the bulbomotor muscles as well as the internal oculomotor branches since the introduction of salvarsan into the therapy. Whether this increase in the number of such cases is due to the injurious effects on the nerve elements of the arsenic or whether it is only a further manifestation of brain syphilis is still an open question.



## VI

### SYMPTOMATOLOGY OF SYPHILIS OF THE BASE OF THE BRAIN

**The Frequency of Paralysis of the Eye Muscles in Lues of the Nervous System.**—Paralysis of the nerves which supply the eye muscles is especially frequent in syphilis of the nervous system. Gräfe says that more than half of all the paralysees of the eye muscles are of specific origin. Alexander, in his monograph "Syphilis and the Eye," states that from 269 cases of eye-muscle paralysis observed by him, 53.5 per cent. were of syphilitic nature. Callus and Wilde found in 141 cases of eye-muscle paralysis syphilis to be the cause of one-third of them.

A glance at the anatomical relations in order to understand the frequency of paralysis of the eye musculature will not be out of place here.

**Course of the Oculomotor Nerve.**—The oculomotor, according to Gegenbaur, leaves the brain just in front of the pons and towards the centre from the crura, runs between the arteria cerebelli superior and inferior anteriorly, and laterally to the side of the posterior clinoid process, where it passes through the dura and enters into the upper wall of the sinus cavernosus. Here it lies on the last bend of the internal carotid and reaches the orbits through the superior orbital fissure. Before its entrance into the orbital fissure it divides into two branches, both of which lie just at the side of the optic nerve. The region in which the oculomotor nerve courses is one whose structures, the pons, crura, blood-vessels, and bony surfaces of the orbital fissure, are particularly inclined to syphilitic processes.

The nucleus of the nerve is also unusually extended, for it reaches from the posterior end of the third ventricle underneath the anterior corpora quadrigemina up to and beneath the posterior corpora quadrigemina. It consists of a large number of large and small ganglion cells, which are

arranged group-like in relation to one another and permit of a division of the entire nucleus into several subdivisions.

**Subdivisions of the Oculomotor Nucleus.**—In regard to the location of the various subdivisions of the oculomotor nucleus, it seems to be definitely settled that the nuclei supplying the sphincter pupillæ and the ciliary muscle lie the farthest forward, that the nucleus supplying the levator



FIG. 34.—Scheme of the oculomotor (1-8) and trochlear (9) nuclei. (According to Perlia.) 1-2 (anterior smaller), 3-8 (posterior larger), subdivisions of the oculomotor nucleus; 8, central nucleus; 4-7, lateral subdivisions; 4 and 5 (dorsal), 6 and 7 (central), parts of the lateral subdivision; 3, nucleus of Edinger and Westphal; 1, fibres for the pupillary movements through the sphincter pupillæ; 2, fibres for the pupillary movements through the levator palpebræ superioris; 3, fibres for the pupillary movements through the convergence and accommodation; 4, fibres for the pupillary movements through the rectus superior; 5, fibres for the pupillary movements through the obliquus inferior; 6, fibres for the pupillary movements through the rectus inferior; 7, fibres for the pupillary movements through the rectus internus. 9 is the schematic representation of the trochlear nucleus.

palpebræ superioris lies anteriorly to the nuclei of the other voluntary eye muscles, and that the Westphal group is connected with the accommodation.

These anatomical conditions explain *a priori* the occurrence of isolated paralyses of the individual internal and external eye muscles.

**The Blood Supply of the Oculomotor.**—The trochlear, abducens, and oculomotor nerves not only receive their blood supply from different sources, but the oculomotor alone is nourished from two separate and distinct regions, the anterior portion being supplied by the *arteria cerebri posterior*, and the posterior from branches given off directly from the basilar artery. For this reason the nucleus of the oculomotor nerve is frequently affected with isolated areas of disease which are produced by the involvement of a single artery.

Fig. 35 represents the schematic plan of the blood supply of the oculomotor.

Shiamura calls attention to another reason why a vascular explanation for the frequency of disease of this nucleus seems probable. The nucleus is situated in the brain at the



FIG. 35.—Plan of the blood supply of the brain-stem, oculomotor nucleus, and root areas. (According to Rossolimo-Shiamura.) *d*, dorsal; *l*, lateral; *m*, mesial arterial regions; 1, fibres from the frontal lobes and the pons; 2, motor tract of the cranial nerves; 3, motor tract of the extremities; 4, fibres from the occipital and temporal lobes.

point where the streams of two great arterial trunks, the carotid on the one hand and the vertebral on the other, come into contact with each other through the agency of the *arteria communicans posterior*. Furthermore, all the arteries supplying the oculomotor nucleus are end-arteries in the sense of Cohnheim, and ascend almost perpendicularly into the substance of the nucleus from the ventral to the dorsal side.

**Separate Course of the Root-fibres.**—The separation of the root fibres of the different groups of the oculomotor nerve before they make their exit out of the brain also furnishes an anatomical basis for the possibility of isolated disturbances of function of the individual eye muscles.

It might be well here to call attention to what both clinical and pathological experience has proven to be true; namely, that a functional disturbance of isolated external (bulbomotor) and internal (pupillary) fibres can present the clinical picture of disease of the oculomotor nerve trunk.

**Course of the Trochlear Nerve.**—The trochlear nerve leaves the brain posterior to the corpora quadrigemina, winds around the crura to the brain base, where it penetrates the dura on the medial edge and anterior portion of the tentorium. With reference to the oculomotor nerve it lies laterally and posteriorly, and with reference to the fifth nerve, above it. It runs inside the dura, parallel with the sinus cavernosus, and, crossing obliquely the oculomotor, attains the supraorbital fissure, as the extreme posterior part of the oculomotor nucleus.

**Course of the Abducens.**—The abducens leaves the brain at the posterior edge of the pons, runs beneath and somewhat medially from the point of exit of the fifth nerve through the dura, in order to ascend at the side of the dorsum sellæ. It enters the sinus cavernosus laterally to the internal carotid and passes through the superior orbital fissure into the orbit. The nucleus lies about in the middle of the floor of the fourth ventricle.

**Is Paralysis of the Eye Muscles Pathognomonic of Lues?**—If one should ask whether paralysis of the eye muscles is somewhat pathognomonic of syphilis of the nervous system, I should feel compelled to answer in the negative. Proofs of syphilis in the anamnesis or other sure evidence of lues must be found before a definite diagnosis of specific disease can be made, although isolated paralysis of one or more of the eye muscles often occurs.

If the specific processes are situated in the anterior cranial fossa, the olfactory nerve, the optic nerve, and the first branch of the trigeminus may be affected and the



nerves of the eye muscles will remain unaffected. If the disease is located in the middle cranial fossa, around the hypophysis, in addition to the nerves of the eye muscles the optic chiasm will also be involved. In disease of the posterior cranial fossa the eye muscles will again escape, and the cranial nerves most apt to be diseased will be the trigeminus and the hypoglossal and the nerves lying between these two.

The histories, however, of many of my cases show that in practice the above scheme does not always hold good, but that the clinical picture of basilar specific meningitis may present much that is irregular.

In the following case, a basilar meningitis, which had caused an isolated oculomotor paralysis, recovered under treatment, but died later of uræmia. The autopsy and pathological examination, both macroscopical and microscopical, confirmed the diagnosis of a lesion of the oculomotor.

A coachman, thirty-three years old, became infected with syphilis in June, 1890. Two months later in addition to well-marked secondary syphilis he developed a left-sided paralysis of the third nerve, which seemed peripheral in character, because external and internal fibres appeared equally affected.

In 1893 this patient took a course of inunctions because of ulcerations on the lower limbs. In 1898 another similar treatment for the relief of cephalalgia nocturna and an ulcer on the right forearm. In 1899 he was again admitted into the hospital because of severe headache, diarrhœa, vomiting, and swelling of the feet and limbs.

Objectively, in so far as the nervous system was concerned, particularly the eye muscles, nothing was to be demonstrated. The patient, however, was suffering with a severe parenchymatous nephritis with an albumin retinitis from which he died in two weeks.

The autopsy showed a parenchymatous nephritis, and in the liver interstitial areas and multiple gummata. In the brain there were slight changes in the basal arteries (the aorta was intact), there were no foci of disease, and the pia

mater over both hemispheres was diffusely clouded and thickened. On the base the pia over the pons and region of the oculomotor bore a similar appearance, the other portions of the base remaining uninvolved.

The microscopical examination of both nuclei of the oculomotor demonstrated normal conditions, with no particular difference between the right and left side.

The following case was one of extensive basilar disease which involved the optic, oculomotor, and fifth, as well as the abducens and facial on the left side.



FIG. 36.—Cerebral basilar lues. Rapid improvement under mixed treatment.

The patient was a woman, thirty-three years old, with a negative history in regard to syphilis.

Four months before, she was seized with severe headache, which shortly disappeared without treatment. It soon returned, however, and more intense than before. The pain came in attacks, usually at night, which were so severe that she could not sleep. Two months later the power of vision in the right eye became poor. This visual loss manifested a considerable degree of variation from day to day. Two weeks before her entrance into the hospital she saw double. When she came into the hospital, examination showed that she was poorly nourished and that the internal organs were normal.

The skull was sensitive to percussion over the frontal and parietal regions on the left side, likewise the points of exit of the left supra- and infraorbital nerves. In the entire area supplied by the first branch of the fifth a slight anæsthesia of the skin and mucous membrane could be demonstrated. The left abducens was paretic, also the left facial. Both pupils, except that they reacted to light slowly, appeared normal. In the background of the right eye one could see a partial atrophy, in the left a slight degree of choked disc.

Under hydro- and electrotherapy the symptoms grew worse, rather than better.

After a week, a course of inunctions and potassium iodid internally was begun. The result was surprising. The headache had improved by the third day, and by the fifth day the abducens and facial paresis had disappeared. Four weeks later anæsthesia remained only in the first branch of the fifth. The second and third branches were normal in their function. In the right eye the optic atrophy remained, but in the left the papilla appeared normal.

The following case is an example of a left-sided facial and auditory nerve disease accompanied by a right-sided hemiplegia:

**Meningitis Basalis Luetica.**—A shoemaker, thirty-six years old, was admitted into the hospital on the 12th of February, 1896. Five months before, he had acquired syphilis, for which he had received mercurial injections.

Four months after the infection a left-sided facial paralysis developed, which was preceded for four weeks by severe pains in the back part of the head and over the left eye. The hearing in the left ear was also affected. Two weeks after his entrance into the hospital diplopia appeared.

The patient was anæmic and poorly nourished. Evidences of past syphilis were found in the form of a scar on the glans penis and indolent swelling of the glands in the groins.

The left facial nerve was completely paralyzed, with involvement of the soft palate and the sense of taste. The hearing in the left ear was lost for both air and bone con-

duction, with normal otoscopic findings. The patient also complained of a roaring noise in the left ear.

Examination of the eyes showed a left abducens paralysis and a narrowing of the field of vision. On the left side of the face the sense of pain was not quite so acute as on the right.

The remainder of the cranial nerves were not affected.

There existed a slight paresis of the right arm, with increase of the tendon reflexes. Increase of the reflexes extended also to the right leg without any other evidence of paresis. The cranium was more sensitive as a whole to percussion on the left side.

Under large doses of mercury and potassium iodid all headache disappeared. In the course of four months the abducens paresis and disturbances of sensation of the right side of the face went away, the hearing improved, the paresis of the right arm cleared up, and the paralysis of the facial, except for a slight trace, disappeared.

A case of basilar meningitis with involvement of the facial and acoustic nerve, with severe mental disturbance:

On the 28th of November, 1898, I saw in consultation a young man twenty-five years old, who fifteen months before had acquired syphilis. The primary lesion was an unusually extensive ulceration, which, together with the macular eruption which followed, healed slowly under intensive mercurial treatment. Six weeks after the healing of the primary lesion, which required about two months, a papular eruption appeared, which again made necessary mercurial treatment. Nine months after the infection, and while the patient was still under treatment, a sarcocele developed, because of which the patient again received mercurial injections and potassium iodid. A month later the patient complained of a continual headache. Two weeks before I saw him he was seized suddenly in his office with a severe attack of dizziness and vomiting. He went to bed right after this attack, and the next morning the left facial was completely paralyzed. The patient was also dazed and later somnolent.

The somnolence lasted six days, the facial paralysis



remaining unchanged. There was also complete loss of hearing in the left ear.

The ophthalmoscopic examination was normal. There were no irregularities of the pupils or paralysis of the eye muscles, also no spinal symptoms.

The facial paralysis, by a marked reduction in the direct and indirect excitability of the faradic current, was shown to be a peripheral one, and localized proximally from the geniculate ganglion. The examination of the ear revealed the loss of hearing to be caused by a paralysis of the eighth nerve. One week later one could demonstrate the reaction of degeneration in the musculature of the affected facial.

The patient was again treated with large doses of mercury and potassium iodid. A maniacal condition now appeared, to which soon were added well-developed delusions of an erotic nature. The maniacal excitement developed to such an extent that the patient had to be transferred to the unruly department of the hospital. Here, besides the delusions above referred to, he had delusions of persecution and thought some one was putting poison in his food, which caused him to refuse his nourishment.

Two weeks later he developed ideas of grandeur, which soon plainly took on the character of mental feebleness. He imagined that he had discovered the syphilis bacillus and wished, like Pasteur and Koch, to earn thereby many millions a year. For this reason he demanded damages for every day which he was kept in the hospital to the amount of 20,000 marks.

The paralysis of the seventh nerve remained entirely refractory to treatment.

The patient was now transferred to a private asylum.

A year later I received a letter from the young man's father, which stated that after eight months in the private institution his son was discharged entirely cured, and has since remained well. To a letter to the father, asking in regard to the paralysis of the facial and of the auditory nerves, I received no answer.

This case is a very important one. It serves to prove that not only in old age and in weakened individuals, but

also in young and healthy persons, the nervous system may become diseased soon after the infection. It shows further that organic and functional (intoxication) disease can appear at the same time, and that energetic antispecific treatment is not always able, even in strong and healthy persons, to protect the nervous system.

The following case is a combination of basilar and cortical meningitis with optic neuritis and partial oculomotor, abducens, trochlear, and facial paresis, with severe epileptic attacks, in all probability caused by disease of the cortex.

An eighteen-year-old boy, one and one-half years ago, was infected extragenitally on the under lip with syphilis. A week before he came to the hospital he had to give up his work as house-servant because of severe headache, attacks of dizziness, and a feeling of great exhaustion. He came to the hospital because his eyesight began to fail.

He was slightly dazed on his admission into the hospital. On his neck traces of leucoderma were found, likewise on his body. In addition to these evidences of lues, there was a general indolent swelling of the glands. He complained of severe headache, and especially of pain deep in the orbits of the eyes. There were choked discs on both sides, with numerous hemorrhages in the retina. The skull was diffusely sensitive to percussion, the power of vision was much diminished.

Under antispecific treatment of six days' duration the headache and boring pain in the eyes improved.

The mydriatic pupils at the time of his entrance into the hospital reacted very slowly to light. Now this reaction was entirely absent; both abducens were parietic, the right more so than the left. A slight paresis could also be demonstrated in the trochlear nerve and the right facial, involving the muscles around the mouth.

The behavior in the reaction of the pupils showed a striking change. In three weeks the left pupil reacted plainly, the right pupil not at all to light. Four weeks later on both sides an almost normal reaction to light was present, and in another week both again were mydriatic and without

reaction to light, and on the very next day both were prompt in their reaction to light.

Under antisppecific treatment the choked discs with the extensive retinal hemorrhages disappeared, but now a specific chorioiditis was revealed, which had existed before. This also slowly disappeared, and there was finally left only a slight pallor of the papillæ. The paralysis of the eye muscles had cleared up.

Four weeks after the patient's entrance into the hospital he was seized with severe epileptic convulsions, which came on either after premonitory symptoms, such as headache, dizziness, paræsthesias in the left upper extremity, feelings of drowsiness and fulness, or without these; also convulsions in the bulbi and the left face musculature. The head was drawn toward the left; the entire body became rigid. The attacks, which began while the patient was conscious, produced unconsciousness, which lasted several minutes and was followed by deep depression and a transient paralysis of the left upper extremity which lasted about ten minutes. A second attack similar to the first one involved, however, first the left side, then both extremities. A third attack from the beginning consisted of general convulsions. In a fourth attack there were only clonic convulsions in the eyelids, paræsthesias, and sensation of pain in the left arm. The consciousness remained intact.

In the further course of the disease the patient often complained of headache and dizziness. After a six months' stay in the hospital he was discharged in good condition. The only objective symptom which remained was a slight pallor of the papillæ.

The patellar reflexes, which, as the only spinal symptom for a long time, were entirely absent, again reappeared.

We observe also in this case, where the patient was both young and strong, and the secondary symptoms had been thoroughly treated, that symptoms of both basilar and cortical nature as well as spinal symptoms developed after two years.

**General Description of the Paralysis of the Eye Musculature in Nervous Syphilis.**—The transient character of a paralysis

of the eye muscles cannot be said to be characteristic of its specific nature, since in such postsyphilitic conditions as *tabes dorsalis* one quite often encounters this symptom.

**The Early Appearance of Paralysis.**—Paralyses of the eye muscles may appear in the earlier stages of the disease. Jefferson reports a case in which this occurred six months after the infection. Saenger saw a paralysis of the oculomotor nerve in the form of ptosis five months after the infection, also another case with oculomotor paralysis and disease of the olfactory and trigeminus five months after the infection.

Wilbrand and Saenger report a case of paralysis of the left oculomotor twelve weeks after the infection.

**The Late Appearance of Paralysis.**—However, paralysis of the eye muscles develops much more frequently in the later stages of lues, and individual forms, especially disease of the internal eye muscles, are most apt to occur long after the infection has taken place.

**Frequency of Oculomotor Paralysis.**—Our pathological studies have shown us that the oculomotor should be the most frequently affected of the cranial nerves, and our clinical experience confirms this.

Uthhoff in his 167 autopsies (17 of his own and 150 taken from the literature) of cerebral syphilis finds the oculomotor nerve to have been affected 66 times, the abducens 29, and the trochlear 6 times. In 259 cases of brain syphilis he found the oculomotor affected in 96 cases. He is convinced that unilateral, isolated, complete, and partial oculomotor paralysis is much more frequent in lues than in any other disease.

Fournier calls the paralysis of the third nerve the eye paralysis *par excellence*.

Alexander reports in 146 cases of specific paralysis of the motor ocular nerves involvement of the oculomotor in 65 per cent., the abducens in 33.5 per cent., and the trochlear in 1.5 per cent.

Uthhoff believes that bilateral involvement of the oculomotor is almost as frequent as unilateral. In 100 clinical cases of brain lues the oculomotor was affected in



36. From these 36 there was bilateral involvement in 15 cases.

**Complete Paralysis of the Oculomotor Nerve.**—The complete paralysis of the oculomotor nerve,—that is, the involvement of all its branches, both internal and external,—occurs far less often than the partial paralysis. Alexander reports 19 cases in which there was a total paralysis of the nerve and 145 cases in which there was a partial.

**Mauther's Theory of Nuclear and Peripheral Paralysis.**—Mauther has propounded the theory that the oculomotor trunk is affected when all its branches are interfered with in their functioning, and, *vice versa*, when only a partial paralysis exists a particular nuclear group is involved. This theory fits in very well with the anatomical relations which have been schematically presented of the various nuclear groups. It also helps to explain the frequent cases of paralysis of isolated muscles, especially the levator palpebræ superior. Clinical and pathological observations at the present time, however, will not justify us in this view.

Uhthoff has conclusively proven, both from his own and other cases, that where apparently the disease of the oculomotor trunk was uniform a disturbance of function of only certain muscles may be produced, so that in a genuine basilar affection it may happen that only the external or the internal muscles will be paralyzed, and that even where both macroscopic and microscopic disease of the trunk have been shown, the function can remain entirely intact.

**Perineuritis of the Individual Intraorbital Branches of the Oculomotor.**—Siemerling has described such a case. A basilar gummatous process had penetrated into the orbit and then followed along the branches of the nerve.

In the case reported by Wilbrand and Saenger, where there was a paralysis of the left oculomotor nerve, together with an anæsthesia in the area supplied by all three branches of the fifth and a paralysis of the facial and auditory nerves, the lesion must have been a gummatous neuritis.

**Secondary Disease of the Oculomotor in the Orbital Fissure.**—Secondary disease of the nerve in the orbital fissure is,

however, more frequent, since here the optic, oculomotor, trochlear, abducens, and first branch of the fifth lie close to one another in a narrow opening, whose bony walls, as well as the periorbital tissue which fills in the space, are quite susceptible to specific disease. We then have a characteristic clinical picture of amaurosis, paralysis of both the external and internal ocular muscles, anæsthesia in the area of the first branch of the fifth, pain deep in the orbit, cedema of the upper eyelid, and slight exophthalmus.

**Disease of the Oculomotor in the Nucleus and Root Area.—**

Gummatous meningitis is the most frequent cause of disease of the third nerve on the base of the brain. The nerve is either compressed in the inflammatory process or the inflammation extends directly to the nerve itself in the form of neuritis and perineuritis gummosa. Gummata may also develop in the region of the nucleus and root area, or these neighborhoods may be damaged by lesions in the pons and crura. The nucleus may be entirely diseased and still only a part of its fibres may be affected. Ophthalmoplegia externa, the paralysis of all the voluntary eye muscles supplied by the third nerve, is most commonly caused by disease of the nerve-trunk.

Of the individual external branches, paralysis of the branch which elevates the eyelid, ptosis is by far the most common and often the only paralysis of the eye muscles in brain syphilis. Lancereaux says it is almost pathognomonic of lues.

**In Disease of the Oculomotor Trunk Isolated Paralysis May Occur.—**The isolated position of the particular nuclei which furnish the nerve supply of the elevator muscle of the eyelid would cause one to suppose that this paralysis would be nuclear in origin. However, as Wilbrand and Saenger have pointed out, there has never been any proof pathologically of this. On the other hand, there have been a number of cases reported of isolated specific ptosis where disease of the nerve-trunk has been found.

**Involvement of the Internal Oculomotor Branches.—**Among the affections of the internal branches of the oculomotor nerve, paralysis of the pupils is extremely frequent, mydri-

asis and the loss of the pupil reactions, both to light and convergence, and their combination with paralysis of accommodation (*ophthalmoplegia interna*).

**Pupil Anomalies in Normal Persons.**—In regard to anomalies of the pupils as to size and shape in normal persons we are indebted to a number of observers for statistics. In 14,392 cases examined, Uhthoff found slight irregularities in 256, or in 18 per cent.; Ivanoff in 134 cases, in 12, or

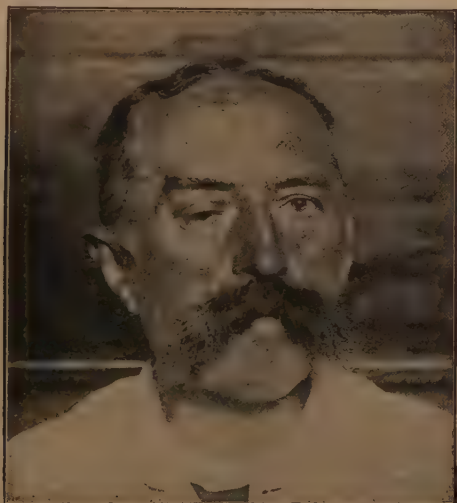


FIG. 37.—Isolated ptosis in a syphilitic.

9 per cent.; Dufour in 173 cases, in 8, or 4.5 per cent. Anomalies of function were not discovered in any of these cases.

Among those diseases which cause isolated anomalies of the pupils one should consider arteriosclerosis first, which, through disease of the arteries in the nucleus and secondary softenings, can cause changes both in the size and function of the pupils.

**Pupil Anomalies in Syphilitics.**—Either unilateral or bilateral myosis with loss of the pupil reaction to light and convergence, accommodation remaining intact, is quite a frequent pupil defect in luetics.

E. Meyer in 74 cases, Bultino in 70, and Mantoux in 101, each saw one case of loss of the reaction of both pupils

to light without any other objective symptoms on the part of the nervous system. These cases were all in persons who previously had had syphilis; otherwise they were normal. The same thing has also been observed by me several times. In one case in particular which received a most thorough examination of the nervous system no other somatic sign could be discovered which in the least could make me suspicious of beginning tabes or general paresis.

Since then I have seen isolated pupil irregularities in a woman twenty-seven years old, in a man thirty years old, in a man fifty-two years old, in a physician forty-seven years old, and in two gentlemen, forty-six and forty-eight years old respectively. In these cases the time of specific infection varied from five to fifteen years.

There were three cases of anisocoria and two cases of double myosis. Anomalies of the accommodation or in the movements of the bulb were not observed. I have had the opportunity of observing these cases over a number of years, varying from six to twelve, and I wish to emphasize the fact that other symptoms which would cause one to be suspicious of tabes or paresis have not appeared.

#### **Loss of the Pupil Reaction to Light as an Isolated Symptom.—**

The question as to whether the isolated loss of the light reaction in the pupil is pathognomonic of syphilis of the nervous system (tabes, paresis, cerebrospinal syphilis, a past syphilis which has been cured) at present according to most authorities is answered in the affirmative. The cases of pupil anomalies occurring in cerebral arteriosclerosis which are the result of arterial disease in the region of the nuclei and secondary areas of softening are not cases of true Argyll-Robertson's pupils. Slowness of the pupil reaction to both light and convergence, anisocoria, myosis and distortion are found not infrequently in severe cases of chronic alcoholism. With one observation as a basis I am forced to believe that genuine Argyll-Robertson pupils may occur as a result of chronic alcoholism alone. In this case not only were the modern methods of examination made use of but an autopsy was performed in which the brain was examined macroscopically and the spinal cord microscopi-



cally. Magulies, in an exhaustive study, mentions the possibility of the isolated loss of the reaction of the pupil to light as the result of chronic alcoholism.

In 1913, Mees published a case from Curschmann's clinic in Mainz with typical isolated loss of the light reaction of the pupil in an alcoholic, with attacks of alcoholic epilepsy and polyneuritis alcoholica. Neither history nor examination revealed evidence of lues, and all four reactions were negative.

The isolated loss of the pupil light reaction may also occur as one of the first symptoms of a beginning syringomyelia (Dejerine, Mirallia, Rose and Lemaitrie, Sicard and Galezowski).

Also, in multiple sclerosis very rarely this condition of the pupil has been reported. Nevertheless, it may be said that the isolated loss of the pupil reaction to light is, in the vast majority of cases, an evidence of nervous lues. Cases of isolated loss of the light reaction and loss of all the pupil reactions are of considerable practical importance. For in them the question is raised: Is a tabes, paresis or cerebrospinal lues developing or are these pupil symptoms to be regarded only as scars of a past specific lesion?

Such authorities as Ravaut, Widal, Babinsky and Erb have shown the importance in such cases for both diagnosis and prognosis of examinations of the spinal fluid.

Assmann, in a study concerning diagnosis by means of spinal fluid examinations with special reference to specific disease of the nervous system, has reported a number of cases with isolated loss of the pupil light reaction and entirely normal behavior of the spinal fluid where other evidences of lues were positive.

Dreyfus made a careful study of this subject, in which he not only examined all his cases with reference to the four reactions but tested these reactions also after a provocative salvarsan injection as well as after the intensive salvarsan-mercurial treatment (4.0 to 6.0 salvarsan, 12.0 calomel, or salicylate of mercury extending over a period of from six to eight weeks). As a result of his studies, he found that isolated pupil disturbances in from 35 per cent. to 40 per

cent. of the cases were only evidences of a past syphilis in which recovery had occurred.

Assmann, in a recent discussion of this subject, comes to the conclusion that cases of isolated pupil anomalies with changes in the spinal fluid are to be differentiated from cases presenting similar symptoms in which the spinal fluid is normal. In the latter cases these symptoms are merely evidences of past lesions of the nervous system which have healed.

Assmann also considers one is not justified in prophesying a later development of tabes or paresis in all cases with isolated pupil anomalies where the spinal fluid shows pathological changes.

I am able to contribute some of my own observations to this important question, which are valuable in that only such cases are included as have been under observation for some time.

These observations were made on 22 patients: 5 were from 1 to 2 years under control; 6 were from 2 to 3 years under control; 3 were from 3 to 4 years under control; 7 were from 4 to 5 years under control; 1 was from 5 to 6 years under control.

The classification of these cases was made first with reference to the findings in the spinal fluid.

1. Spinal fluid from the beginning normal. Rudimentary processes.

2. Spinal fluid in the beginning pathological; at present normal; lesions of central nervous system which have healed.

3. Spinal fluid findings improved; not entirely normal, clinical course improved.

4. Spinal fluid unchanged; clinical course unchanged.

5. Spinal fluid as in beginning; further developments of the disease.

1. Normal spinal fluid:

CASE I.—Merchant, thirty-five years old. Nervous from birth. Lues 1899, intensively treated for years; thinks he has heart disease.

September 21, 1912: Excitable, nervous man; right pupil

> left Argyll-Robertson pupil; left pupil normal. Otherwise everything normal; heart particularly so; four reactions normal.

December 19, 1913: Later examinations: Subjective, complains of pains in back. Objective, all conditions unchanged.

February 17, 1914: Subjective, no complaints. Objective, no changes. Four reactions negative.

CASE II.—Infection questionable; for a long time creeping sensations in head and drawing in limbs.

October 27, 1911: Status: Right pupil > left, loss of light reaction. Wassermann in blood +. In spinal fluid 0.8  $\theta$ . Phase I  $\theta$ . Lymphocytosis  $\theta$ .

Later examination:

December 15, 1913: Subjective, at times tinnitus aurium. Objective, unchanged. Wassermann in blood  $\theta$ .

CASE III.—Merchant, twenty-two years old. The father had lues and died with paresis. Mother contracted syphilis at age of eighteen, before her marriage. At present healthy. Patient has suffered since birth with severe attacks of migraine.

March 15, 1909: Status: Left pupil > right, in both loss of reaction to light and convergence. Wassermann in blood +.

Later examinations:

August 20, 1910: Subjective, still headache at times. Objective, right, minimal reactions to light and convergence. Wassermann in blood +. In spinal fluid 1.0  $\theta$ . Phase I  $\theta$ . Lymphocytosis  $\theta$ .

September 27, 1911: Subjective, almost no complaints. Objective, unchanged. Four reactions unchanged.

January 5, 1914: Subjective, excellent. Objective, status and reaction unchanged.

In these three cases the pupil changes were the only symptoms of a specific process in the nervous system which, according to the negative findings in the spinal fluid, must be regarded as having recovered. According to the anamnesis one may consider the first two cases as of the rudimentary type. In the first case, recovery was brought about by the specific treatment, and, in the second case, since no treat-

ment was administered, a spontaneous recovery must have taken place. In the third case, earlier changes in the spinal fluid may almost with certainty be assumed, since the source of the infection was derived from the parents and no specific treatment was ever administered until he came under my care.

A fourth case in this category is important because it came to autopsy. For this reason it is described more in detail.

A tradeswoman was received into my department at Eppendorf with a severe attack of delirium tremens. She had been for a long time a heavy drinker. Much emaciated and anæmic, she showed symptoms of a beginning pulmonary tuberculosis. The anamnesis stated that thirteen years previously she had a specific infection and at that time received a course of mercurial inunctions. She had as a stigma of syphilis a large perforation of the soft palate. The examination of the nervous system revealed the following abnormalities:

Anisocoria, slight degree of myosis, distortion of both pupils; genuine Argyll-Robertson pupils; other objective symptoms were lacking.

The Wassermann reaction in the blood at first examination was negative; three weeks later + + +. Spinal fluid 0 with 1.0. Lymphocytosis 12/3. Phase I negative.

This patient died after a stay in the hospital of about one year, of her lung affection. The autopsy revealed tuberculosis of the lungs, myodegeneratio cordis, aortitis luetica in beginning of aorta. Macroscopically the brain and spinal cord presented a normal appearance. Microscopically there was not the slightest evidence of paresis, tabes or cerebrospinal syphilis.

In so far as I know, also, Bumke, who is one of the best informed concerning the literature of the pupils, in answer to my question, said that he knew of no case having been reported where an Argyll-Robertson pupil existed with Wassermann, cell and globulin content negative and where the brain and spinal cord examined microscopically by an expert had not shown evidence of a specific central nerve



affection. This case proves, in my opinion, that we are no longer justified in saying, with Möbius, every case of loss of the pupil reaction is an evidence of an existing tabes, paresis or cerebrospinal lues. This case proves further that an isolated loss of pupil reaction may represent a residuum of a former syphilitic pathological process and that we may assume the termination of this process, if the spinal fluid reactions are negative.

2. Spinal fluid at first pathological, later normal cases where the lesions have healed:

CASE I.—An engineer, twenty-eight years old. Syphilis in 1903; glimmering before the eyes.

February 5, 1912: Status: Right pupil > left, lazy reaction. Paresis to accommodation in right eye.

August 7, 1912: Re-examination: Subjective, better, only left eye now weaker. Objective, paresis of accommodation in both eyes. Otherwise unchanged. Wassermann in blood ++. Wassermann in spinal fluid 0.2 ++++. Phase I+. Lymphocytosis ++++. Therapy: Salvarsan  $4 \times 0.3$  +. Potassium iodid.

April 12, 1913: Re-examination: Subjective, no complaints. Objective, paresis of accommodation right; light reaction on both sides sluggish.

September 2, 1913: Subjective, easily tired, tense. Objective, left pupil mydriatic; loss of reaction to light and convergence; right pupil medium sized; reaction to light and convergence a little slow. Four reactions negative.

February 3, 1914: Re-examination: Subjective, good, except for occasional pressure over left eye. Objective, left pupil reacts feebly to light. No reaction to convergence. Right pupil above normal size; reacts normally to light, feebly to convergence.

In these two cases the earlier pathological condition of the spinal fluid has by means of treatment been changed to normal after a year in the first case and six months in the second. The prognosis in both cases for a complete recovery may be considered good.

In the following case where there occurred a very marked improvement, but the pathological condition of the spinal

fluid although improved is not entirely normal, the prognosis is not so favorable.

3. Spinal fluid improved but not entirely normal:

CASE VII.—Merchant, forty-one years old. Lues July, 1910; treated repeatedly; 6 months after infection angina specifica; papules on the head; renewed treatment. A year afterwards, convulsions and unconsciousness. At present, severe headache, nausea, vomiting, dysuria, vision in right eye bad.

October 3, 1911: Status: Right pupil > left, distorted. Light reaction of both eyes sluggish; choked disc right. Wassermann in blood + + +. Wassermann in spinal fluid 0.2 + +; 0.4 + + +. Phase I +. Pleocytosis + +. Therapy: Salvarsan  $4 \times 0.3$  +. Potassium iodid.

October 26, 1911: Re-examination: Subjective, no complaints. Objective, only the anisocoria.

May 30, 1912: Re-examination: Subjective and objective, unchanged. Wassermann in blood 0. Wassermann in spinal fluid 0, with 1.0 c.c. Phase I +. Lymphocytosis 18/3.

February 7, 1913: Re-examination: Right pupil > than left; otherwise, everything is normal. Wassermann in blood 0. In spinal fluid 0, with 1.0 c.c. Phase I +. Lymphocytosis 0.

In the four cases under observation in this series the subjective symptoms disappeared entirely and the objective made marked improvement. In the spinal fluid in VIII and IX a slight increase in the globulin remained; in VIII and X, a pleocytosis. The Wassermann in the spinal fluid in VII, IX and X became negative with 1 c.c. of fluid; in Case VIII, however, positive with 0.4, while a year earlier it was positive only with 0.6. The future must teach us whether a negative Wassermann is of greater importance in a favorable prognosis than an absence of the globulin and lymphocytosis reactions.

In the next group of cases, while the changes in the spinal fluid were severe in character, there was no evidence of an advance in the diseased processes.

4. Spinal fluid continuing pathological clinical picture stationary:

CASE XI.—Merchant, fifty years old. Lues in 1902; thoroughly treated; vision for some time past bad; pressure symptoms on head; complains of feeling tired.

October 19, 1909: Status: Ophthalmoplegia interior, left. Therapy: Course of inunctions ( $62 \times 5$  Gm. ung. hg. cin.).

January 21, 1910: Re-examination: Left pupil  $>$  right; sluggish reaction to light and convergence; accommodation left diminished. Wassermann in blood  $\theta$ .

March 20, 1911: Re-examination: Light reaction in both pupils sluggish; convergence better; Wassermann in blood  $+$ . In spinal fluid 0.6  $+$ . Phase I  $+++$ . Lymphocytosis  $++$ . Therapy: 1.49 salvarsan.

December 28, 1911: Re-examination: Subjective, splendid. Objective, unchanged. Wassermann in blood positive. In spinal fluid, 0.4  $+$ ; 0.6  $++$ ; 1.0  $+++$ . Phase I  $+++$ . Lymphocytosis  $+++$ .

November 22, 1913: Re-examination: Subjective, at times pains in the limbs. Objective, light reaction right a little; left none. Accommodation left diminished. Wassermann in blood  $\theta$ . In spinal fluid 0.5  $+$ ; 0.8  $+++$ . Phase I  $+$ . Lymphocytosis  $+$ . Therapy: Inunction course.

February 4, 1914: Re-examination: Subjective, splendid, works every day. Objective, unchanged.

It cannot at present be regarded as definitely settled that these ten cases, of which Case XI is a fair illustration, are not future candidates for tabes and paresis, as Dreyfus suspects in cases where the pathological changes in the spinal fluid continue refractory to treatment. The long period of observation, however, with no apparent progress of the disease, would tend to minimize this fear.

5. Spinal fluid pathological. Further progress of the disease:

CASE XXI.—K., merchant, twenty-nine years old. Lues probably, 1902. Patient is somewhat feeble-minded. It is possible that the parents also had lues; severe pains in the limbs; painful urination.

May 25, 1906: Status: Left pupil  $>$  right, reacts slowly to light and convergence; paresis of accommodation left.

February 11, 1909: Re-examination: Subjective, dysuria,

rheumatic pains. Objective, dilated pupils not reacting to light. Convergence reaction left slow. Pain postponement and mammillary zone uncertain. Wassermann in blood 0.

May 17, 1911: Subjective, at times attacks of dizziness; lightning pains in the legs. Objective, dilated pupils; no reaction to light and Achilles reflex on both sides 0; Romberg +. Ataxia, hypalgesia, delayed pain sensation. Wassermann in blood + +.

CASE XXIII.—Merchant, forty-nine years old. Lues, 1900. Intensive mercurial treatment by inunction. Received a year ago potassium iodid because of pupil disturbance; afterwards improvement. At present paræsthesia in hands and limbs; dysuria; obstipation.

January 31, 1909: Status: Pupils narrow, distorted, no reaction to light convergence; left prompt, right sluggish. Slight Wassermann in blood, +. In spinal fluid 0.2 0. Phase I +. Lymphocytosis + +. Therapy: Inunction course (120 Gm.) +. Potassium iodid.

January 11, 1910: Re-examination: Subjective, the same complaints. Objective, right pupil all reaction lost. Left convergence retained. Wassermann in blood +. Wassermann in spinal fluid + +.

February 13, 1910: Re-examination: Acutely beginning mental disturbance. Patient is confused, excited, not clean. Transferred to asylum.

March 10, 1910: Re-examination: Pupils unchanged; tongue tremor; active reflexes; high degree of dementia; articulatory speech disturbance.

May 19, 1910: Subjective, fairly clear, quiet, harmless, euphoric. Objective, unchanged. Discharged.

October 19, 1910: Re-examination: Subjective, paræsthesia; digestive disturbances. Objective, unchanged. Wassermann in blood +. Phase I +. Lymphocytosis +.

December 3, 1910: Recently increasing restlessness and mental confusion. Again transferred to asylum.

December 7, 1910: Re-examination: Articular speech disturbance; dementia; ideas of grandeur.

December 12, 1911: Re-examination: Mentally better; more quiet. Objective, unchanged. Discharged.



February 9, 1914: Re-examination: Subjective, the last two years engaged in active business. Objective, pupils unchanged. Achilles reflex right almost 0. Romberg +. Hypotonia, ataxia, lightning pains.

Case XXI began with merely an ophthalmoplegia interna, and in a period of five years developed a complete tabes.

Cases XXII and XXIII were similar. A year after their pupil disturbances were recorded, both developed paresis, the course of which was interrupted by long periods of remission. Steyerthal reported quite similar characteristics in the clinical histories of 100 paretics whom he observed for eighteen years; besides the cases which remained stationary, he observed many times great improvement which lasted for years. It is worthy of mention that in the 13 cases in the last two groups, where the observation period was the same, 10 remained stationary and only 3 were progressive.

**Anomalies in the Reaction of the Pupils in Persons Who Have Never Had Syphilis Have Frequently Been Observed by Me.**—From a review of the literature one is apt to get the impression that isolated pupil irregularities are positive symptoms of lues. It is important to bring out here that this is not always the case, although such an isolated symptom should cause one to be extremely suspicious of syphilis.

The following are reports on cases of this kind which have come under my observation:

1. Male, fifty-three years old, alcoholic, right eye, loss of reaction to light, left reaction slow, anisocoria, and distortion of the pupils.

2. Male, fifty-eight years old, alcoholic, bilateral myosis and loss of the light reaction.

3. Male, twenty-six years old, alcoholic, right pupil myotic, left slightly mydriatic; right light reaction normal, left, loss of the reaction to light.

4. Male, forty-three years old, alcoholic, anisocoria, loss of the light response on both sides.

5. Male, fifty-three years old, non-alcoholic, loss of both the reaction to light and convergence in both eyes.

6. Male, forty years old, non-alcoholic, myosis, both eyes, and loss of the pupil reflexes to light.

7. The wife of this man, who was also a non-syphilitic, had a left ophthalmoplegia interna as an isolated symptom.

8. A maiden lady, forty-eight years old, with slight mental depression without parietic or psychic stigmata, had myosis and loss of the light reaction on both sides.

9. Male, fifty-two years old, alcoholic, anisocoria, both pupils irregular in shape, loss of light reaction in both, spinal fluid lymphocytosis slightly positive, globulin reaction negative.

10. Male, forty years old, alcoholic, light reaction lost in both pupils.

11. Male, forty-four years old, alcoholic, myosis and loss of the light reaction on the left side, lymphocytosis and globulin reactions negative.

In seven of these eleven cases severe alcoholism was present; in four no toxic agent could be discovered.

It is interesting to observe the reaction in the spinal fluid in these cases of isolated pupil anomalies both with and without evidence of syphilis in the history.

In those cases where syphilis could be demonstrated there was only one which reacted negatively in regard to the globulin and lymphocytosis. On the other hand, in eight of the eleven cases reported above, in which a spinal puncture was made, both the reactions were negative in six cases. In the other two, one gave a weak positive globulin reaction and a moderate lymphocytosis, the other a slight lymphocytosis and a negative globulin reaction.

Uhthoff in 100 cases of cerebral syphilis found loss of the light reaction with intact convergence in ten cases, and loss of both the light reaction and convergence in four.

He has called attention to the wide difference in the frequency of appearance of these pupil irregularities in tabes and cerebrospinal lues.

In tabes they occur in from 60 to 90 per cent. of the cases, in cerebrospinal lues in 14 per cent.

Mikloszewski pointed out, in 1900, that a variation in the size of the pupils cannot always be regarded as conclusive evidence of organic disease. He has observed this phenomenon twice in entirely normal persons, twice in

functional neuralgias, four times in hysteria, and once each in vitium cordis, nephritis, tuberculosis, and acute rheumatism. He explains the phenomenon by the assumption of a functional alteration in the sympathetic nervous system.

**Ophthalmoplegia Interna.**—Ophthalmoplegia interna (paralysis of the pupils and paralysis of accommodation) is stated by Alexander as the most frequent manifestation of syphilis on the motor apparatus of the eye.

This affection, in Alexander's observations, always appeared as unilateral. In 77 such cases which he has had the opportunity of observing, in 76 per cent. lues either as a positive or probable cause could be demonstrated. Mooren discovered syphilis in two-thirds of such cases examined by him, while Uhthoff, on the other hand, found syphilis in only 23.3 per cent. of his cases.

In two cases, both in women, I saw a unilateral ophthalmoplegia interna as an isolated symptom on the part of the nervous system. In one case exposure of the face to cold could be ascribed as the cause. In the other there was no etiological factor apparent. In both cases my observation extended over a period of three and four years respectively without the development of other symptoms.

The cases of Alexander which recovered developed later into tabes. In other cases the ophthalmoplegia interna proved to be a prodromal symptom of severe mental disturbances, usually of paresis.

**A Precursor of Postsyphilitic Disease.**—It is extremely important to remember, however, that generally ophthalmoplegia interna, as well as the combination with it of myosis, is a precursor of severe postsyphilitic disease of the brain and spinal cord, and that it may be present a long time before the outbreak of the tabes or paresis. In a patient of Donath it was five years after the determination of the loss of the pupil reflexes to light before the development of the paresis.

One could regard such a case as already tabes if only a single further symptom, such as loss of the patellar reflexes, the Achilles tendon reflexes, or the occasional appearance of lightning pains in the limbs, or disturbances of

digestion of a crisis-like nature, or girdle sensations around the body, is present.

That such cases are cases of *tabes abortiva* or *tabes imperfecta* should be recognized by every one. One must certainly admit that cases of isolated loss of the pupil reflexes may precede many long years the appearance of a well-developed *tabes*, and so it becomes easier to understand Möbius and the majority of the French school when they place all of these cases in the category of *tabes*. I have had four experiences which have caused me to be exceedingly cautious in this particular.

The first one was in a physician in the prime of life who as a student had acquired *lues*. During the twelve years that I knew him—how much longer I do not know—he had a bilateral myosis with loss of the pupil reaction to light without other symptoms, when suddenly he developed a severe *tabes* with ataxia and paralysis of the bladder.

The second case was also one of a physician who as a student had contracted syphilis. He had for ten years a double mydriasis with loss of the pupil reflexes to light. During these ten years his physical and mental condition was extremely robust and his activity extensive. After a short period of depression, with change in his appearance and character, he developed a galloping form of general paresis.

The other cases were similar in nature.

In spite of such cases, however, I am at the present time, because of my own personal experience, inclined to the opinion that cases of loss of the pupil reactions may occur rarely as the only symptom of an existing syphilis without the further development in later years of *tabes* or paresis.

Summary of Oculomotor Paralysis Occurring in Syphilis.—

A brief enumeration of the various paralyzes of the oculomotor nerve occurring in cerebral syphilis will not be out of place here. As we have seen, one may have a paralysis of both the internal and external branches, or the external alone, or the internal alone. The external muscles likewise, either isolated or in any combination, may be paralyzed. Of the internal muscles, only the sphincter and the muscles



of accommodation, and these again in different combinations with the external muscles either unilateral or bilateral, may be affected. We have further seen that ptosis, the paralysis of the elevator of the upper lid, is the most frequent in brain lues.

One also often sees in brain syphilis both complete and incomplete ophthalmoplegia externa.

The opinion of Hutchinson that such a paralysis in the majority of cases is due to an affection of the nucleus is not correct.

Autopsies have shown, as in disease of the collective external branches of the oculomotor nerve, that the lesions are peripheral.

**Disease of the Abducens.**—In regard to the frequency of disease of the abducens, Uhthoff in 17 autopsies found that the abducens was affected three times, and in 150 cases collected from the literature 27 times. In the 27 cases a bilateral involvement occurred only six times, which is in remarkable contrast to the frequency of the bilateral affection of the oculomotor.

The pathological causes of disease of the abducens are affections of the pons in the form of a softening due to specific arterial disease, syphilitic new growths, basilar luetic disease, and even in rare cases a neuritis and perineuritis of the nerve itself.

If the abducens is affected within the pons one finds usually accompanying the disturbance of the sixth nerve a paralysis of the facial on the same side or a contralateral paralysis of the extremities.

Involvement of the abducens on one side without a crossed facial or extremity paralysis is usually due to basilar disease.

**Paralysis of the Trochlear.**—Uhthoff found in his 17 autopsies involvement of the trochlear only once. In this case there was a basilar gummatous meningitis. In the 150 cases taken from the literature the trochlear was affected six times. The reason for the rare involvement of the trochlear lies in the protection which it receives because of its location.

It is worthy of mention that the trochlear nerve has never been reported in an autopsy as affected alone, but always in combination with other cranial nerves.

**Nystagmus.**—Nystagmus has been observed in cerebrospinal lues.

Uhthoff in his review of 150 cases found it reported as occurring in two.

The exceedingly rare occurrence of this symptom in specific nervous disease is in contrast to its rather frequent occurrence in other cerebrospinal affections, as notably multiple sclerosis.

Paralysis of the eye muscles when the treatment has not been instituted early and carried out in an energetic manner is rather stubborn and in some cases entirely refractory.

There are cases, however, of paralysis of the eye muscles which are transient in character. Nevertheless, the slight tendency of the paralyses of these muscles to be transient in nature in basilar syphilis is an important diagnostic distinction when compared with the fleeting nature of the paralysis which occurs as a precursor of, or in the course of, *tabes dorsalis*.

## VII

### SYMPTOMATOLOGY AND PROGNOSIS OF SPECIFIC BASILAR MENINGITIS

**The Differential Diagnosis of the Paralysis of the Eye Muscles in Cerebrospinal Lues and Tabes Dorsalis.**—There is a similarity between the two paralyses. Isolated paralysis may occur in both; likewise ptosis and pupil disturbances are especially frequent, and one observes in both ophthalmoplegia externa.

**Tabes Dorsalis.**—Fournier states as a means of differentiation (1) that in tabes the paralysis of the oculomotor is only a partial one; (2) the external paralyses are often found in combination with the Argyll-Robertson phenomenon (the loss of the pupil reaction to light, convergence remaining intact), and (3) the paralyses of the eye muscles in tabes are more transient in character and apt to recur.

These points of differentiation enumerated by Fournier are not at the present time considered of so much value as they were once thought to be, because we know now that all of these conditions may occur in brain lues. The Argyll-Robertson phenomenon is, however, much more common in tabes (according to Uhthoff occurring in from 60 to 90 per cent. of the cases).

Saenger has called attention to a distinction found by him in the examination of ten cases of brain syphilis. In these cases the pupils of the patients did not at first react to light, but after having them remain in a dark room for several hours he was able to obtain the light reaction. In cases of tabes the stay in the dark room did not restore the light reaction. Saenger sees, therefore, in this phenomenon a symptom of diagnostic value between tabes and brain lues.

Treupel has reported a case of tabes with an intermittent loss of the pupil reaction to light.

This rare condition has been observed by me in two cases.

With a loss of the light reaction on one side and an optic neuritis on the same side, one may safely diagnose the case as brain lues.

In regard to the pathological difference between tabes and brain syphilis, especially since the comprehensive labors of Siemerling and Bödeker, it has been demonstrated that in tabes the lesion consists frequently in a primary nuclear atrophy along with a primary peripheral neuritis.

The assumption that the paralysis of the eye muscles in tabes is produced through the trophic influence of the sympathetic has not been proven.

Siemerling and Bödeker explain the transient nature of these paralyses on the theory that the disintegrated Nissl bodies are capable of restitution, and that in the nuclear atrophy of tabes we encounter a stage-like process of cell deterioration.

**Progressive Ophthalmoplegia.**—In cases of progressive ophthalmoplegia one must also take into consideration the possibility of bulbar paralysis and disease of the anterior horns of the spinal cord.

One may likewise encounter combinations here, as an interesting case reported by Sachs shows. In this case, in addition to an ophthalmoplegia and symptoms of an atypical tabes, there were evidences of an affection of the anterior horns.

**Brain Tumor on the Base.**—The differential diagnosis between a specific basilar meningitis and a brain tumor of the base can also present difficulties. The tumors which develop on the base of the frontal lobes or in the crura, through either direct involvement or pressure on the basal nerves, may produce symptoms similar to those occurring in specific meningitis.

Tumor of the brain base of five years' duration, paralysis of the eye muscles and disease of the optic nerve. Remissions and variations in intensity of the symptoms. Suspicion of lues in the personal history:

A woman, thirty-six years old, seen first by me December 18, 1895, previous to her present illness had always been healthy. During the past five weeks she had suffered with



severe headache and occasional vomiting. Soon after the beginning of the headache she complained of double vision. Objectively there was found a left abducens paralysis. There was also tenderness to percussion on the left side of the cranium, especially the left frontal region.

As a result of two months of mixed treatment all the symptoms disappeared. The patient remained free from symptoms for a period of five months, when the headache and vomiting reappeared. Objectively there were found at this time, again, a left abducens paralysis, paresis of the left rectus internus and the left levator palpebræ superioris muscle, also a slight optic neuritis on both sides.

As a result of further antispecific treatment the headache and paralysis of the ocular muscles disappeared. However, several weeks later both the headache and the eye paralysis returned, and this time did not respond to the treatment. In the summer of 1898 the patient took two months' treatment of hydrotherapy and electricity in the Eppendorf Hospital and appeared to have been greatly benefited temporarily thereby.

The neuritis optica had become more marked and bore more the character of choked disc. In the fall of 1899 some new symptoms appeared: paræsthesias and pressing pains in the left side of the face, attacks of trismus, and diminished sense of smell on the left side. Suspicion of a slow-growing tumor on the base of the brain was now expressed.

The condition of choked disc had passed into a partial atrophy. The variation in the power of vision of the patient from day to day was striking. On some days she was entirely blind in her left eye; on others sometimes for an hour or two; sometimes the entire day she was able to count fingers and distinguish between persons with it.

In March, 1900, she showed for the first time a protrusion of the left eye, and began to have epileptiform attacks, both with and without loss of consciousness. In two months from this time the patient died.

At the postmortem the dura over both frontal lobes was adherent. The lamina cribrosa of both ethmoids was destroyed and filled in with a tumorous growth. The lower

half of the left frontal lobe was occupied by a tumor. The frontal lobes inferiorly were grown together and an extension of the tumorous growth could be demonstrated on the lower surface of the right frontal lobe. The tumor was a fibrosarcoma.

In this case the onset with headache and vomiting, the suspicion of a previous syphilitic infection, the abducens paralysis and partial paresis of the oculomotor nerve, the variation in the ocular paralyses and the visual disturbances, and the apparent improvement produced by anti-specific treatment were responsible in the beginning for the diagnosis of syphilitic basilar meningitis. At the present time the four reactions would clear up the diagnosis in such a case.

**Meningitis Cysticercus.**—Meningitis cysticercus may also present a clinical picture resembling basilar meningitis. In this form of meningitis the symptoms are subject to even a greater variation than in the specific form; the course is also more acute.

**Multiple Sclerosis.**—In multiple sclerosis, in addition to the perhaps too much emphasized nystagmus, one also finds external and, in rare cases, internal paralysis of the ocular muscles.

The ocular paralyses in multiple sclerosis are also apt to be transient in nature.

Disease of the optic nerve often occurs in multiple sclerosis. An affection of the optic nerve may occur in this disease before any symptoms on the part of the eyes have appeared. It is apt to be more transient in character than in syphilis, and causes less often total blindness.

Since patients who have previously been infected with syphilis may have multiple sclerosis, and, on the other hand, cases have been described in which cerebrospinal sclerosis symptomatically resembled cerebrospinal lues, one can easily understand how under certain circumstances a differential diagnosis between the two diseases may be extremely difficult.

In the case of a man, forty-two years old, who previously had contracted lues, because of a sudden paresis of

the facial and paralysis of the eye muscles, which in the course of two weeks was followed by a spastic paresis of the lower extremities, both Eisenlohr and myself diagnosed cerebrospinal syphilis. Only when antispecific therapy produced no improvement, and in the further course of the case ataxic paresis of the upper extremities, along with nystagmus, developed, did it become clear that the case was one of multiple sclerosis.

**Cerebral Hemorrhages.**—Cerebral hemorrhages can also cause isolated paralysis of the eye muscles. This is easily explainable from the nature of the blood supply. According to Shiamura's schematic representation the arterial region lying along the median line, in the neighborhood of the nucleus of the third nerve, composed of branches given off from the posterior communicating arteries, can be regarded as an isolated one, and does not communicate with the arterial system which supplies the cerebral peduncles and the tegmentum. This medianly-situated arterial region supplies the blood for the oculomotor and red nuclei.

**Head Injuries.**—The nerves of the eye muscles may also suffer damage from head injuries.

Differential diagnostic difficulties will not occur in most of these cases, because of the existing etiological factor. If the patient, however, has had syphilis, and the physician does not discover the ocular palsy until some time has elapsed after the accident, he may then be in doubt as to whether he should attribute the condition to trauma or to syphilis.

**Tubercular and Epidemic Meningitis.**—Tubercular basilar meningitis may be distinguished from the luetic variety by the more acute course of the former and the presence of fever, which is probably never absent.

The same is true of cerebrospinal meningitis of the epidemic type.

**Relapsing Oculomotor Paralysis.**—Oculomotor paralysis of the recurring type has nothing to do with syphilis. What its origin is, at the present time we do not know. Cases of this affection occur not infrequently with symptoms of meningeal irritation, headache, stiffness of the neck, and

vomiting. If syphilis is present in the history, before the disease has completed its course, naturally the diagnosis will remain in doubt.

**The Trigeminal Nerve.**—The trigeminus nerve lies on the base of the brain between the trochlear and abducens nerves. The fifth nerve may in a specific basilar meningitis be either involved alone or in combination with other cranial nerves. A consideration of the anatomy of this nerve shows us that not only is its nucleus widely distributed, but also its branches ramify extensively through the foramina, bony sinuses, and fissures of the cranial bone. Specific processes on the bony edges of the orbit and in the orbit itself are, of course, liable to involve the first branch of the nerve. Disease of the second branch is often associated with the affections of the nasal cavities and the antrum. Likewise a narrowing of the foramen ovale on the base of the brain and disease of the lower jaw would involve the third branch. In the interior of the skull, disease of the middle cranial fossa may cause a disease of some or all of the branches of the nerve. In the region of the nucleus one encounters all the processes which have been spoken of in relation to the ocular paralyses, hemorrhages, areas of softening, sclerosis, and tumors.

One sees not infrequently isolated-appearing neuralgias in the first and second branches of the fifth, both in the early and late stages of syphilis.

A jurist, who two years before coming to me had acquired syphilis, was seized with severe neuralgic pains in the first branch of the trigeminus. After the customary medication, combined with electricity, had failed to relieve, antispecific treatment was administered and the neuralgia quickly disappeared. This patient about every two years has a return of his neuralgia, which always promptly disappears under antispecific therapy.

This case brings up the question which has often been brought up in regard to cases of isolated facial paralysis in the early stages of syphilis, as to whether the lues predisposes to facial neuralgia, or whether a small localized process on the brain base exists. The frequency of appear-



ance of both these conditions without any of the accompanying symptoms of a meningitis speaks in favor of the first assumption.

Alexander reports two cases in which facial neuralgia was the only symptom of syphilis. Uthoff in 37 autopsies found the fifth nerve affected alone four times.

Alexander has often observed involvement of the trigeminal together with the optic, facial, abducens, and trochlear, and in four cases he has seen a keratitis neuro-paralytica appear as the result of lues.

According to Uthoff, the nerves most often affected along with the fifth occur in point of frequency in the following order: optic, facial, oculomotor, abducens, acoustic, olfactory, and trochlear.

Oppenheim and Pick have both described cases of degeneration of the spinal trigeminal root. In all of these cases the degeneration was unilateral in contradistinction to the bilateral disease in tabes. In Pick's case the cause of the degeneration was a destruction of the trigeminal region by a gummatous growth. In the case of Oppenheim and Pick the degeneration was secondary, due to disease of the Gasserian ganglion.

Rumpf has been unable to find in the literature any case in which the sense of taste was lost as a consequence of syphilis.

He himself reports one case in which the sense of taste on the left side of the tip of the tongue was diminished. Under antispecific therapy this disappeared, only to return later. Two years afterward the patient developed paresis.

We will again quote from Uthoff concerning the frequency of the involvement of the fifth nerve in syphilis. He found in 17 of his own autopsies disease of the trigeminus three times, and in 150 cases taken from the literature, 22 times. There was involvement of the nerve on both sides only once.

**Involvement of the Facial Nerve.**—As in the case of the eye muscles, the facial nerve, which runs a long and devious course, may be affected either in its nucleus, roots, or trunk. What has been said in regard to the oculomotor nerve, that

the gummatous growths may advance along the roots up into the nucleus, is also true of the facial.

I have never been able to find a case of peripheral facial paralysis, due to Heubner's arteritis, in the trunk of the nerve, although one must admit the possibility.

In the facial, the electrical examination, in contrast to the ocular paralysis, can be utilized to differentiate between the paralysees which are caused by lesions in the nucleus and below it and those which are supranuclear and cortical.

The peripheral facial paralysis, when it occurs in combination with other paralysees, whether they are from the cranial nerves or of the extremities, is found much less often than the pontine type. As a matter of fact, one frequently sees in brain syphilis facial paralysis caused either by areas of softening in the pons, which is produced by arteritic disease in the basilar artery, or by gummatous infiltration, combined with an alternating paralysis of the extremities.

Not infrequently one encounters an isolated facial paralysis in secondary syphilis. I have observed eight such cases, cases which did not differ apparently in any way from the ordinary peripheral form. In these cases it does not seem that we have to deal with the ordinary specific basilar meningitis, because the other cranial nerves are not affected, and there are no accompanying general symptoms. Furthermore, the paralysis runs a course which is not influenced by antispecific therapy. We may assume in these cases that they are simply produced by the general injurious effect of syphilis in the body, as a result of which the predisposition to rheumatic disease of the facial is increased.

Some observers, as Boix and Dargaud, take an opposite view of these cases and regard them in every instance as due either to gummatous meningitis or specific periosteal disease.

Bernhardt, Goldflam, Hatschek, Gowers, and Hoffmann believe that Boix's opinion does not hold good for all cases, but they also recognize that an increased predisposition is produced in the system as a result of syphilis.

Bernhardt in a monograph on recurring facial paralysis, published in 1899, proves that recurring facial paralysis also occurs in luetics. I have observed one case of this type of paralysis in a syphilitic which developed twice after a slight rheumatic attack, the first time without electrical changes, the second time with a partial R. D. Other nerves were not affected.

Both times the paralysis disappeared without antispecific treatment.

Transient facial paralyses, peripheral in nature, are also observed in the initial stages of tabes. In such cases occurring in luetics one should always keep in mind the possibility of disease of the posterior columns. Recently, isolated cases of facial paralysis have been given importance as often occurring as the so-called nervous relapses (neuro-recidive) after salvarsan administration. Lumbar puncture shows in many cases that the three reactions are positive. In a recent case I found this to be true. Such observations prove what one formerly could only regard as probable, that such peripheral facial paralyses are actually syphilitic in nature.

**Disease of the Eighth Nerve.**—In 1903 Quinke reported two cases in which the eighth nerves were affected in common with the seventh. In the first case, in addition to the involvement of both auditory and both facials, the abducens was affected. Recovery occurred under antispecific treatment. In the other case the auditory symptoms predominated. This case came to autopsy. Here the deafness of the patient was found to be due to degeneration of both auditory nerves, and the facial paralysis on the right side to degeneration of the facial nerve.

Oppenheim complains that in the cases reported in the literature one frequently finds no clinical differential diagnosis made between an affection of the auditory nerve and the sound-conducting apparatus. In the case reported above, the diagnosis "nervous deafness" was made because the sense of hearing was decreased for moderate tones, normal for high tones, and there was evidence of severe functional exhaustion.

Rosenstein has made a comprehensive review of the cases of disease of the auditory nerve due to syphilis. It appears from Rosenstein's studies that specific affection of the eighth nerve is much more frequent than has hitherto been supposed. The function of the nerve has not been examined carefully enough.

We know now that specific neuritis of the auditory nerve may often be slight in character and sometimes present no subjective disturbance whatever. Failure to examine thoroughly the other cranial nerves is often responsible for the failure of observing an affection of the eighth nerve. This has especially been shown to be true since the era of nervous relapses (neurorecidive). We know now, since the eighth nerve is being more carefully examined, that it is affected in the early stages of lues much more frequently than it was formerly thought to be. On the other hand, the mistake is sometimes made in luetics in assuming disease of the auditory nerve, when in reality middle-ear disease exists.

The auditory nerve is more frequently affected in syphilis than the olfactory. Frequent cause of its disease is by the extension of specific processes from the petrous portion of the temporal bone or through compression, as a result of periosteal narrowing in the inner-ear passages. The most frequent cause, however, is basilar gummatous meningitis.

The nerve is susceptible to the same degenerative processes in its nucleus and trunk as the facial. The nerve-endings in the labyrinth are also sometimes diseased, and not infrequently in the early stages of lues.

Kreiblich says that in his experience the tendency has been usually in the early stages of syphilis to conclude that the quickly appearing difficulty in hearing was not due to disease of the nerve, but rather to refer it to some disturbance in the sound-conducting apparatus, to a transmitted inflammation from the throat and inflammation of the middle ear. He has observed four cases in one year of disease of the labyrinth, and all of them occurred in the early stages of lues, three or four months after the infection, partly due to a purely cochlear affection and partly as a result of



combined disease of the vestibule and the semicircular canals.

The disturbances in hearing consist in a loss of the high tones, while deep tones are heard as disagreeable sounds. Disease of the vestibule and semicircular canals manifests itself in dizziness, nausea, inclination to vomit, accompanied at the same time by subjective noises and diminished hearing.

In one of my cases, a young man twenty-eight years old, who had contracted a lip chancre and during the following year and a half took three courses of inunctions, soon after the completion of the third inunction course there developed both subjective and objective disturbances of the above-described nature in the right ear, along with severe headache. The headache disappeared after the administration of potassium iodid, while the subjective ear noises continued. There was found on the right side a diminished capacity for the perception of high tones, with a subjective painful sensitiveness to these tones. Deep tones were heard normally straight out from the ear, but to the left were intensified; whispered speech was normal in the left ear, in the right heard only when spoken directly into the ear. A diagnosis of labyrinthine disease was made. In spite of large doses of potassium iodid in the next few weeks, an abducens paralysis developed, with such intense dizziness that walking was almost impossible.

Another inunction course with sweat baths and large doses of potassium iodid brought about recovery in the course of six weeks. The patient has remained well up to the present time, a period of four years.

**Ménière's Symptom-complex.**—One finds in the various monographs on the subject of brain syphilis that Ménière's symptom-complex may also occur as the result of cerebral lues. One may assume syphilitic disease of the bones in the labyrinth as the etiological factor. However, so far as I know, there has been no pathological confirmation of this assumption.

**Glossopharyngeal Nerve.**—Disturbances of the glossopharyngeal, which supplies the posterior third of the

tongue, the mucous membrane of the soft palate, and the palatine arch with taste, furnishes sensation to the tonsils, the posterior pharynx, the mucous membrane of the tympanic cavity and the cells of the mastoid process, and is concerned in the act of swallowing, may be manifold in character.

Reports of isolated disease of this nerve have never come under my observation, but in all the pathological processes which involve the last four cranial nerves, whether in the nuclear region, the root sphere inside and outside of the medulla, it may also be affected. One should always be on the lookout, however, when there are taste disturbances in the posterior portion of the tongue for suppurative affections of the middle ear or simple catarrh of the tympanic cavity. Oppenheim reports a case in which a pachymeningitis through a puckering and compression of the medulla and the nerves coming out from it produced an acute-developing aphonia, a paralysis of swallowing and respiration, tachycardia, and hemiatrophy of the tongue.

**Symptoms Caused by Disease of the Vagus.**—These may be manifested by pulse anomalies, disturbances of respiration, and paralysis of the vocal cords.

In a case of paralysis of the left recurrent laryngeal one is apt to think either of an aneurism of the aorta or of an infiltrating process in the apex of the lung, both of which may be specific in nature.

Enlarged mediastinal glands may also cause vagus symptoms.

Remak reports a case in which twelve years after the syphilitic infection a paralysis of the vocal cords and an accessory paralysis along with increased frequency of the pulse appeared.

In this case Remak was in doubt whether to attribute the symptoms as due to a primary specific neuritis or a secondary injury caused by a pachymeningitis syphilitica in the region of the anterior roots of the upper cervical nerves.

**The Hypoglossal Nerve.**—The hypoglossal, in addition to being involved along with the other bulbar nerves, may

sometimes become affected alone. Remak has reported such a case in which he found the hypoglossal compressed in the condyloid foramen through gummatous proliferation.

According to the observations of Ballet, Raymond, Koch, and Marie in paralysis of the vagus and accessory, in ophthalmoplegia, and in hemiatrophy of the tongue, one should thoroughly examine the patient in order to determine whether or not *tubes* is the underlying cause.

Bernhardt has reported a case of hemiparalysis of the tongue which was caused by a syphilitic swelling of the cervical glands. Dinkler has described a case with atrophy of the tongue which he explained by a pressure neuritis of the hypoglossal caused by a syphilitic periostitis of the condyloid foramen.

**Pons and Medulla.**—Symptoms originating from the brain stem (the pons and medulla) may also be caused by syphilis. Here naturally one encounters the same pathological lesions, such as tumors and arterial changes, with their consequent terminations in aneurisms, hemorrhages, thromboses, and softenings.

**Blood Supply.**—It has been recognized for a long time that aneurismal formations of the vertebral artery as a result of specific arterial disease are comparatively frequent, while in the branches supplying the central ganglia they seldom occur. The arteries of the posterior cranial fossa are not so liable to specific disease as those in the middle cranial fossa. However, one may observe through specific disease of the vertebrals either an acute or chronic bulbar paralysis.

Arterial symptoms arising from the cerebellum are not very common, because the cerebellum is supplied by two large arteries, both branches from the basilar and vertebral arteries, which afford good opportunities for collateral circulation.

The classical symptom-complex for a focal lesion in the cerebral peduncles is, because of the passage of the oculomotor fibres, a contralateral hemiplegia and a homolateral oculomotor paralysis. Since the fibres of the third nerve are separated in the peduncles lesions here frequently cause

isolated paralysis of the ocular muscles supplied by it. Hemiplegia alternans superior is only encountered when the lesion lies higher up in the peduncles and involves the optic tract. We find then, along with the hemiplegia, a hemianopsia.

When the pons is affected there occurs then in addition to the contralateral hemiplegia either a paralysis on the same side of the oculomotor, abducens, and facial nerves of a peripheral character, if the lesion has affected their respective nuclei or their outgoing intrapontine fibres, or a paralysis on the same side of the muscles of mastication points to an involvement of the motor trigeminal nucleus, a facial hemianæsthesia to an affection of the sensory trigeminal nucleus or of their outgoing fibres.

Two cases of brain lues observed by me presented the clinical picture of tumor of the cerebellar pontine angle. In one of these cases on one side there was a paralysis of the facial and auditory nerves and loss of the corneal reflex, while at the same time there was still present on the body a late secondary papular eruption. In the other case there was, besides the paralysis of the seventh and eighth nerves, involvement of all three branches of the fifth in the form of anæsthesia and a keratitis neuroparalytica.

**Medulla.**—An affection of the medulla, under certain circumstances, can cause, through injury of the auditory nucleus, a central disturbance of hearing, and through injury of the glossopharyngeal and vagus nuclei and their fibres a disturbance of the circulation, respiration, and difficulty in swallowing. A paralysis of the accessory will manifest itself through a paresis of the vocal cords and a paralysis of the trapezius and sternocleidomastoid muscles. Disease of the hypoglossal causes a disturbance in the motility of the tongue.

As in the ordinary arteriosclerosis, so also in specific endarteritis, one may encounter the clinical picture of acute or subacute bulbar paralysis or of poliencephalitis superior (Wernicke), according as the region supplied by the basilar artery is affected and thereby the nuclear areas of the oculomotor, trochlear, abducens, and facial suffer, while



in disease of the vertebral only the areas of the strictly bulbar nerves are affected.

In every case of disease of this portion of the brain one should bear in mind the possibility of a syphilitic cause and when any shadow of doubt exists to institute an energetic and thorough antispecific therapy. The application of the four reactions here will in most cases dispel the doubt.

**Glycosuria and Polyuria.**—In brain syphilis glycosuria now and then occurs.

When a patient presents himself who complains of headache and has sugar in his urine, among other etiological factors one should not forget to consider syphilis.

The chief causes of this symptom-complex are head injuries, brain tumors, and brain lues, and very often indeed brain gummata which are not situated in the medulla produce glycosuria. In the majority of the cases there is a basilar gummatous meningitis and a localization of the same in the region of the chiasm.

One may assume this to be the case if, in characteristic sequence, paralysis of the cranial nerves with polydipsia, and especially hemianoptic disturbances either with or without hemiplegia, develop.

Brain tumors in which glycosuria enters into the symptomatology are also most often situated in the chiasm region.

There is, however, a glycosuria which occurs in syphilitic arteritis without any symptoms of involvement of the base of the brain or of the medulla, in which a hemiplegia is the only clinical expression of the specific arterial affection.

**Diabetes Mellitus.**—There is also a diabetes mellitus in syphilitic patients which occurs as an isolated symptom. One should regard such cases in the same category as those cases of isolated idiopathic epilepsy and primary optic atrophy inluetics. It is not produced by the localization of a specific process on a certain spot, but develops as the result of the indirect influence of syphilis on the system.

Syphilis does not seem to be common in diabetics. In an analysis of 692 cases of diabetes mellitus Rumpf found

a history of syphilis in 84 cases, 13 per cent. He was unable, however, in any of the cases to find either directly or indirectly any relationship existing between the syphilis and the diabetes.

Naunyn says that it is quite probable that syphilis may be a cause of diabetes mellitus. He finds, however, after a careful review of the literature, that lues seldom produces diabetes, and that still more seldom are any beneficial results in diabetes obtained by antispecific treatment.

Manchot in his work on this subject defines the required limitations necessary in order to establish a relationship between syphilis and glycosuria. According to this observer, it must be proven that syphilis existed before the appearance of the sugar. The glycosuria must appear at the same time as other symptoms of lues in the system, and, lastly, it must recede under antispecific therapy along with the other symptoms and without the necessity of having instituted a diabetic diet.

The following case fulfils these requirements.

Case of diabetes mellitus with an arteritisluetica appearing at the same time:

A merchant, thirty-six years old, who eight months before had contracted syphilis, at the time I saw him was in a highly-excited mental state. The year before he had been examined for life insurance and was then entirely normal.

In the hospital, for a period of about two weeks he presented the picture with normal somatic findings of a manic state and abnormal irritability. At the same time he showed some evidences of grandiose ideas. He complained of headache and was unable to sleep. From the time of his entrance into the hospital there was sugar in the urine, in amount about 3 per cent. Under large doses of mercury and iodid the patient gradually became quiet, the sugar at first remaining the same. However, after the eighth week the sugar began to disappear, and at the end of four months the quantity of sugar had diminished to 0.3 per cent. At the end of six months, the patient in the meantime having otherwise fully recovered, the quantity of sugar was 0.8 per cent.

**Diabetes Insipidus.**—Diabetes insipidus may occur as a result of syphilis, caused either by a gummatous brain tumor or by a basilar meningitis. A typical case has been described by Buttersack in which the interpeduncular region was severely affected. The polydipsia appeared first. Other cases have been reported by various observers.

In all these cases the polyuria developed either with or after other brain symptoms, usually a long time after the infection. The most frequently associated symptoms were hemianopsia and internal and external ocular paralysis. In one of my cases the infection had been acquired thirty years before the appearance of the diabetes insipidus. Cases have been reported, although rare, in which the polyuria existed as the only symptom.

In some of these cases the diagnosis of a specific cause to account for the diabetes insipidus was made from the result of the specific therapy. In the future we will depend upon the four reactions to establish this relationship. In a case reported by Staub, however, the paralysis of the eye muscles receded but the polyuria and polydipsia remained uninfluenced.

**Prognosis of Brain Syphilis.**—We will discuss the prognosis of brain syphilis in general, although the various forms present different prognoses.

In the beginning of my discussion of this subject I wish, with Oppenheim, to make this statement: that brain syphilis is a serious organic brain disease, which frequently causes death, often leads to a chronic state, but also in not a small number of cases may end in recovery. The prognosis in brain syphilis is much more favorable than in the other organic affections, such as brain tumor, brain abscess, multiple sclerosis, and paresis. The first two conditions may in some instances be cured by operative procedures, although in tumor cerebri the end result is in the majority of cases only a partial one. In brain abscess also the cases are not frequent in which the process does not appear in multiple form and before surgical relief can be given has caused a secondary meningitis.

In multiple sclerosis, although the process may advance very slowly and exhibit long remissions, nevertheless we know that it is a disease which ends in death. The same is true of paresis.

To obtain a numerical representation of the prognosis of brain syphilis is exceedingly difficult, because the cases in the first place should have been observed for a long time, and this is only possible in a comparatively small number of cases, since the patients pass out from under the physician's control and later, when they come under other observation, not infrequently are not recognized as brain syphilis. In my own experience I have not been able to keep under a sufficiently long observation one-third of the cases which have been entered at Eppendorf as cerebral lues.

**Statistics.**—In the following statistics only cases of specific meningitis, gummatous brain syphilis, andluetie arteritis have been included.

Fournier states that a third of his cases were cured, about one-half improved, and one-sixth of them died. Rumpf in 31 cases reports that five died, eight remained very sick, improvement occurred in six, and recovery in twelve. Hjelmann and Walter Berger do not report so favorable an experience. They estimate the fatal cases or those who are left with severe disturbances as about half, the cases which recover one-fourth. In the remaining cases improvement occurs. In Hjelmann's material death occurred in one-fourth of the cases within six months after the appearance of the first cerebral symptoms, in about one-half of the cases within the first two years.

Naunyn from 88 of his own cases and 325 collected out of the literature has made a very careful study of the prognosis in brain lues. He has classified under recovery only those cases in which no relapse has occurred inside of five years. He reports 27 cases in this category. I have been able to observe in 124 cases only 22 which have gone over a period of five years without a relapse. There are many more cases of recovery since the last attack, of two or three years' duration, which Naunyn has proven from his



320 collected cases, that must be excluded from his five-year period. They relapse before the expiration of this time.

**A Partial Recovery.**—A partial recovery was found by Naunyn in 49 of his 88 cases and in 48 per cent. of his collected cases. Among his own cases ten became worse and five died. In 56 cases of my own which had remained well for over a period of three years I found a partial recovery to be by far of more frequent occurrence. There were 34 such cases, 10 cases grew worse, and 12 died.

**Recurrences.**—Relapses occur very frequently. In 56 cases observed by me for a period of three years, 22 cases relapsed once, eight cases relapsed several times. It is chiefly because of this tendency that the uncertainty in our prognosis exists. An apparently complete recovery for the time being does not offer any guarantee against a return of the disease. It is this fact which has given rise to the expression, "Syphilis does not die, it only sleeps."

Relapses may appear again under the same form; for instance, a second attack of arteritis, an exacerbation of the specific meningitis, a new gummatous tumor may occur, or, on the other hand an arteritis may follow a meningeal affection, or *vice versa*, as the case may be. The relapse may appear soon after the termination of the last outbreak, or years may intervene. The interval may present a condition of full recovery or contain some symptoms remaining from the last attack.

The prognosis depends upon a number of individual factors which must be considered separately.

**1. Age of Patient at Time of Infection.**—The first of these is the age of the patient at the time the infection was contracted. According to both Hjelmman and Naunyn, age up to forty years has no influence on the prognosis. Both of these authorities agree with Ricord and Fournier that the prognosis becomes worse the older one becomes after the age of forty before acquiring the disease. My own experience, however, does not entirely coincide with their view. I have seen now and then in young persons brain syphilis run a malignant course, and, on the other hand, cases of both the meningeal and arteritic forms in patients who had

been infected in their forties and fifties, and in one case in the sixty-fourth year, pursue benign courses.

2. **The Interval between the Time of the Infection and the Outbreak of the Brain Affection.**—In this regard Hjelmann and Naunyn agree. They both state that the interval up to ten years is without influence on the prognosis, but that in a longer interval the prognosis becomes worse.

In comparing my own experience in 124 cases I find, in the four cases of recovery which were kept under observation over five years, the interval in two cases was two years and in two cases three years. In those which ended in death the interval in two was four years, in three cases five years, and two cases each 9, 10, 12, 14, 15 and 30 years respectively. In the relapsing cases the interval varied from 6 to 25 years. In more than one-half of the cases the interval was over 10 years.

3. **Heredity, a Bad Nervous Inheritance.**—Concerning this factor Oppenheim makes this statement that in so far as he has been able to observe, a bad nervous inheritance is without influence on the prognosis. My own experience coincides with this.

4. **Debilitating Agents.**—These are doubtless important in the prognosis. It makes considerable difference whether a robust individual is attacked by brain lues or one who either through a tubercular inheritance, or tuberculosis itself, through chlorosis and anæmia, and especially through alcohol, has been weakened.

We have seen previously in Tarnowsky's statistics of 100 patients with brain syphilis that 43 were chronic alcoholics, that there were also numerous cases of neurasthenia, head injuries, and marked mental exhaustion. Tarnowsky puts the blame for a bad prognosis on such factors. He regards the prognosis in patients who are free from any of these harmful influences as very favorable. My own experience does not entirely harmonize with Tarnowsky's view. I have had cases which ran a malignant course where none of these factors were present.

**Head Injuries.**—The importance of head injuries has probably been overestimated. Oppenheim states that he

has seen cases in which relapses have appeared apparently as a result of an injury to the head. Personally I have never been able to observe that a head injury very often produces brain syphilis, or that the affection when it did develop was inclined to be any more severe than otherwise.

**5. Form and Degree of the Primary and Secondary Symptoms.**—A question which has been much discussed and is important is whether the course of the syphilis from the beginning of the primary lesion has any effect upon the prognosis of a later-developing cerebral lues.

In general all authorities are of the opinion that syphilis of the nervous system, and especially the parasymphilitic affections, tabes, and paresis, follow more frequently after the milder types of the primary and secondary symptoms. It has often been said that the mildness and insignificance of these earlier symptoms is the cause of the later-developing visceral lues, because in such apparently mild forms the antispecific therapy was not energetic enough.

A perusal of the literature on this point is not very satisfactory, because one finds only a very few cases in which the previous symptoms have been mentioned. However, it is apparent that many cases occur in which there was a mild primary lesion and some secondary symptoms which promptly responded to antispecific treatment. On the other hand, there are enough cases where both the primary lesion and secondary symptoms were severe.

Fournier is of the opinion that there is a type of lues ("*Syphilis à virus nerveaux*") which is especially inclined, both early and severely, to attack the nervous system. Just as there are cases of galloping syphilis, cases in which severe secondary and tertiary symptoms follow each other uninfluenced by treatment, so also there are cases of brain syphilis which never become quiescent. These cases may appear, however, after either light or severe primary and secondary symptoms.

**6. Extragenital Infection.**—With reference to an extragenital infection, I have never been able to observe that it has ever had an unfavorable influence upon a later cerebral syphilis.

7. **Previous Treatment.**—The question as to whether the mode of the previous treatment has any influence on the course of a later-developing syphilitic brain affection is important.

Many authors are of the opinion that an insufficient treatment of the primary and secondary symptoms is the cause of the following disease of the nervous system. Hjelmann goes so far as to say that from 82 to 88 per cent. of the cases of brain lues have either had insufficient treatment or no treatment at all; that in the majority of cases thorough antisyphilitic treatment would have prevented the outbreak on the part of the nervous system. On the other hand, the same author says the prognosis of brain lues is not influenced by previous mercurial treatment.

The opinions of different authors are, unfortunately, extremely contradictory on this point. While Kaposi, Rumpf, Lamy, and recently Oppenheim consider that earlier thorough and energetic antisyphilitic treatment improves the outlook against the development of brain syphilis, Mauriac, Leyden, and Herxheimer deny that it does.

In my personal experience I have observed so many cases of severe cerebral lues which have had such careful earlier antisyphilitic therapy that I am loath to believe that the manner or degree of previous treatment has any influence worth mentioning on the later development of brain syphilis. Recently, however, Mattauschek, from the study of a vast clinical material (officers of the Austrian army) that had been under control and observation for many years, has determined that in syphilis which has been well treated the nervous system is affected only half as often as it is after insufficient treatment.

All observers agree that the timely and efficient treatment of the first symptoms of brain lues which appear is important, although I have seen cases—and cases are reported by such authorities as Fournier and Gilles de la Tourette—in which the first manifestations of cerebral lues developed during antisyphilitic treatment, also cases in which the brain affection, in spite of intensive treatment, steadily continued to progress. Such cases are, however, the excep-



tion. One should remember that syphilitic processes react best and quickest to treatment if they are recent processes, which have not as yet caused regressive changes, such as are found in gummata and connective-tissue scars.

**Difference between Clinical and Anatomical Recovery.**—One must take into consideration the difference which exists between a recovery in the anatomical sense and a recovery in the clinical sense.

A gumma may be said to have healed anatomically if in place of the specific gummatous tissue, connective tissue has been formed. A specific meningitis is cured if in place of the inflammatory infiltration scar tissue has been substituted. In so far as the clinical anomalies are concerned, however, it makes no difference whether they are caused by the presence of specific tissue or by connective tissue which supplants the nerve substance. This factor stands out more prominently, naturally, in a spinal cord affection than it does in a brain affection, and tends to weaken one's assurance in the value of the therapy.

**Prognosis in Localized Meningitis.**—Specific meningitis represents the most favorable type of brain syphilis in so far as the prognosis is concerned.

Hjelmann says that 71 per cent. of the cases of recovery belong to this form of the disease, Naunyn comes to a similar conclusion, and Oppenheim states that in ten cases of complete recovery which came under his personal observation the essential symptoms in all of them were produced by a basilar meningitis.

**Diffuse Meningeal Infiltration.**—The outlook in diffuse meningeal infiltrations is far less favorable, because almost always the nerve tissue is affected and frequently the symptoms are of so indefinite a character for a long time that proper treatment is not begun soon enough.

The cases of meningitis of the convexity have, as a rule, a good prognosis, although the initial symptoms may be of an alarming character, such as partial or general epileptic attacks.

**Isolated Gummata.**—The true gummata, under which classification I do not include the gummatous processes of

the many meningeal forms but only the isolated tumors, frequently react well to mercury and potassium iodid, but sometimes they are quite refractory to treatment or they react up to a certain point and then remain stationary.

In general one can say that a reaction of the symptoms to the antispecific treatment, where potassium iodid is administered, should make itself manifest at the end of one week; where mercury is used, at the end of two weeks. It doubtless occasionally happens that the reaction takes place in some cases later, but after the third week the outlook for a favorable result from the treatment becomes rapidly worse if no response has been obtained before.

Naunyn in 155 cases of recovery which he has collected found that improvement began either at the end of the first or second week after the inception of the treatment.

**Arteritis.**—The cases of syphilitic arteritis have, as a rule, a serious prognosis. The specific infiltration in the walls of the arteries may, of course, be reabsorbed in a Heubner's arteritis. The narrowing of the lumen will, however, be little affected by this, as it does not depend upon the proliferation of the products of syphilitic inflammation. That part of the brain in which necrosis has begun will never recover.

In occasional instances one may observe the complete recovery of an arteritic hemiplegia. Fournier states that he has seen ten cases of arteritic hemiplegia which recovered inside of a few weeks. Hutchinson describes a case of arteritic hemiplegia in which the recovery still remains good after ten years.

The danger in syphilitic arteritis is its tendency to relapse.

The memory and intelligence are not as apt to suffer in specific arteritis as in arteriosclerosis of the ordinary type.

The prognosis with regard to life is also better, as syphilitic arteritis seldom causes death. In 44 cases which came under observation no fatality was caused by the arteritis.

The paralysis recovers usually more fully when the patient is in a good physical condition or is not of too advanced an age.

If the paralysis after from two to four weeks shows no indication of improvement, one may conclude as in the non-specific hemiplegias that the condition will be permanent. An arteritic hemiplegia will recover sooner than a hemiplegia, a triplegia, or a pseudobulbar paralysis, because the lesion is smaller. The appearance of contractures indicates the permanency of the condition.

In my own 44 cases there were only six which completely recovered in a few weeks; in the others a greater or less degree of paresis remained. The most of these patients passed out from under my observation. In 16 cases which I was able to follow for over four years, five relapsed, three developed other forms of brain syphilis, two general paresis, and six have remained well, except for a slight residual paralysis.

The prognosis of arteritic disease of the basilar artery is always grave, because this artery supplies the most important vital centres. The outlook for restitution where the arterial affection involves the nuclear regions is also not good, as has been shown in the study of disease of the oculomotor nucleus.

**Summary.**—Owing to the practical importance of this subject the following summary in tabular form has been collected from my hospital and private practice and also from the literature.

In the general summary table by the term "heredity" is understood the occurrence of functional neurosis and psychoses as well as organic disease of the central nervous system in the antecedents; by the "type of syphilis" whether the syphilis has appeared in severe form in any one of its three stages or in all of them, and whether it has been refractory to treatment. The term "interval" indicates the time which has elapsed between the initial lesion and the appearance of the nervous affection. By "weakening factors" are meant anæmia, particularly mental and physical strains, acute and chronic psychic and physical trauma, and excesses in alcohol, tobacco, and venery.

The 185 cases comprise brain, spinal, and cerebrospinal syphilis.





In the following table of 185 cases, 72 recovered, 30 were very materially improved, and 122, so far as could be determined, suffered no relapse:

TABLE B

Died.....	16 cases = 10.8 per cent.	} 46 cases = 31.1 per cent.
Unimproved.....	30 cases = 20.3 per cent.	
Improved.....	30 cases = 20.3 per cent.	} 102 cases = 68.9 per cent.
Recovered.....	72 cases = 48.6 per cent.	

The prognosis is presented in Table C. Under the term "good" is meant recovered or very much improved, and under "bad" unimproved or very little improved or died.

TABLE C

I. Sex.	Good.	Bad.
	Per cent.	Per cent.
Male.....	64 cases = 68.1	30 cases = 31.9
Female.....	38 cases = 70.4	16 cases = 39.6
II. Age.	Good.	Bad.
	Per cent.	Per cent.
1-10 years.....	2 cases = 100	0 case = 0.0
10-20 years.....	0 case = 0.0	1 case = 100
20-30 years.....	13 cases = 76.5	4 cases = 23.5
30-40 years.....	45 cases = 77.6	13 cases = 22.4
40-50 years.....	29 cases = 63.0	17 cases = 37.0
50-60 years.....	12 cases = 63.2	7 cases = 36.8
60-70 years.....	0 case = 0.0	2 cases = 100
III. Heredity.	Good.	Bad.
	Per cent.	Per cent.
Good heredity.....	71 cases = 68.3	33 cases = 31.7
Poor heredity.....	13 cases = 65.0	7 cases = 35.0
IV. Age at time of infection.	Good.	Bad.
	Per cent.	Per cent.
Under 40 years.....	61 cases = 70.1	26 cases = 29.9
Over 40 years.....	7 cases = 63.7	4 cases = 36.4
V. Type of syphilis.	Good.	Bad.
	Per cent.	Per cent.
Severe.....	15 cases = 57.7	11 cases = 42.3
Mild.....	15 cases = 75.0	5 cases = 25.0
Extragenital.....	4 cases = 57.1	3 cases = 42.9
VI. Treatment of syphilis.	Good.	Bad.
	Per cent.	Per cent.
Untreated.....	32 cases = 65.3	17 cases = 34.7
Insufficient treatment.....	10 cases = 71.4	4 cases = 28.6
Sufficient treatment.....	44 cases = 68.7	20 cases = 31.3

TABLE C—Continued.

VII. Interval.	Good.	Bad.
	Per cent.	Per cent.
1-10 years. ....	45 cases = 73.8	16 cases = 26.2
Over 10 years. ....	25 cases = 64.1	14 cases = 35.9
VIII. Weakening factors.	Good.	Bad.
	Per cent.	Per cent.
Lacking. ....	60 cases = 73.2	22 cases = 26.8
Present. ....	42 cases = 63.6	24 cases = 36.4
IX. Form of disease of central nervous system.	Good.	Bad.
	Per cent.	Per cent.
Cerebral. ....	67 cases = 71.3	27 cases = 28.7
Spinal. ....	16 cases = 61.5	10 cases = 38.5
Cerebrospinal. ....	19 cases = 67.9	9 cases = 32.1
Arterial. ....	20 cases = 66.6	10 cases = 33.9
Meningeal. ....	72 cases = 69.2	32 cases = 30.8
Meningeal and arterial. ....	10 cases = 71.4	4 cases = 28.6
X. Relapses.	Good.	Bad.
	Per cent.	Per cent.
No relapses. ....	71 cases = 76.3	22 cases = 23.7
One relapse. ....	17 cases = 58.6	12 cases = 41.4
Several relapses. ....	14 cases = 60.9	9 cases = 39.1

In regard to the individual factors which influence the prognosis, I wish to make the following observations:

*First.* Sex has no influence on the prognosis.

*Second.* The prognosis is best between the ages of twenty and forty. After forty it becomes at first slowly poorer and then later rapidly so. In old age the outlook is entirely bad.

*Third.* According to my experience, the prognosis in the cases with a bad nervous inheritance is not as good as in the cases without it.

*Fourth.* The prognosis becomes worse in cases where the syphilis was contracted after the age of forty.

*Fifth.* In my own cases where the disease had shown a severe form in the primary and secondary stages there was also a tendency to a more severe course in the nervous system than in those cases where the early syphilis had been of a mild type.

*Sixth.* Although astonishing, it seems to be a pretty definitely settled fact that the prognosis in those cases which have either received no treatment or insufficient treatment appears just as good as in those cases which have received thorough treatment.

*Seventh.* When the interval between the time of the infection and the outbreak of the nervous symptoms is over ten years the influence on the prognosis is unfavorable.

*Eighth.* The weakening factors exert an unfavorable influence on the prognosis.

*Ninth.* There appears to be no essential difference in the prognosis between syphilis of the brain, spinal cord, and cerebrospinal lues.

*Tenth.* The prognosis is better in cases which show no relapses. A number of relapses do not seem to decrease the chances of the final outcome in comparison with the cases which have suffered one relapse.

Table D gives the year of the relapse dating from the time of the nervous outbreak.

TABLE D

First year.....	20 cases = 31.7 per cent.
Second year.....	21 cases = 33.3 per cent.
Third year.....	9 cases = 14.3 per cent.
Fourth year.....	5 cases = 7.9 per cent.
Seventh year.....	1 case = 1.6 per cent.
Tenth year.....	2 cases = 3.2 per cent.
Sixteenth year.....	1 case = 1.6 per cent.
Twenty-second year.....	2 cases = 2.3 per cent.

## VIII

### NEUROSES AND PSYCHOSES IN SYPHILITICS AND IN CEREBRAL SYPHILIS

IN the consideration of brain lues, psychic disturbances for several reasons merit special attention: First, because in true syphilis the disturbances of the intellectual activity are frequent and manifold; second, because without gross pathological lesions in the brain in syphilitics various mental affections of typical and atypical forms may occur; and, third, because the exceedingly important ailment, dementia paralytica, in the great majority of the cases is to be regarded as a postsyphilitic disease.

**Historical.**—It has been recognized for a long time that the psychic functions may be disturbed in cerebral lues. Bell has reported a case of chronic mania in a syphilitic woman who suffered with headache and epilepsy and was relieved of both affections by the administration of mercury.

Cases of cerebral syphilis do occur in which no real psychic disturbances whatever are manifested; usually, however, close observation will reveal mild psychic anomalies in the majority of the cases.

It has also been recognized for a long time that the so-called "functional psychoses" (cases of brain syphilis are not included in this category) can occur in luetics. Lagneau was the first to direct our attention to this. He divided the functional psychoses in syphilitics into melancholia, mania, dementia, and idiocy.

The question of chief importance in regard to this subject is to determine whether the syphilitic virus in itself can so alter the brain that it causes the development of a psychosis which may be said to be characteristic of syphilis, and may be distinguished as such from the psychoses of non-syphilitics.

The "simple or functional psychosis" first mentioned by Lagneau was also as such, occurring in syphilis, recog-



nized later by a large number of observers, among whom were Albers, Erlenmeyer, and Jolly. Erlenmeyer has written an especially comprehensive monograph concerning syphilis and mental diseases, in which he divides the mental affections in lues into the so-called simple or functional psychoses, the psychoses which are complicated with disturbances of motion and sensation, and the various types of general paresis.

Fournier distinguished two conditions, a chronic depressive state with a gradually developing loss of the intellect, and acute type with a greater or less degree of excitement in the form of delirium and mania, which latter he attributed to brain irritation.

Heubner recognized likewise the occurrence of a simple or functional psychosis in syphilitics and in addition differentiated the disturbances of the psychic functions into the three forms of organic specific brain disease as classified by him.

In gummatous disease of the brain convexity, according to Heubner, there predominates a condition of depression and irritability which may develop into either a deep melancholic or maniacal state, and is not infrequently followed by loss of memory and intelligence, as well as changes in the disposition.

Corresponding to the location of the pathological lesion this condition is combined with the various forms of aphasia and cortical irritations and paralyses. In the arteritis of the basilar arteries Heubner states that one is more apt to encounter mental feebleness, while in arteritis on the convexity the mental symptoms exhibited are similar to an intoxicated condition, a condition of semiconsciousness where the patient undertakes and carries out certain acts while in this dazed state.

This form of impairment of the intellectual capacity is characterized also by the accompanying symptoms of paralysis and cortical irritation.

The relationship which exists between lues and the so-called functional neuroses, neurasthenia and hysteria, has also received much attention.

**The Different Ways in Which Syphilis Causes Psychic Disturbances.**—There are various ways in which a syphilitic infection can produce disturbances of the mental activity. If we regard the psychic impairment as an expression of the disturbances of nutrition, then these disturbances may be brought about in one of two ways: either by a change in the blood itself, or by disease of the passages through which the blood is conducted to the tissues.

The nervous elements may also be damaged by the post-syphilitic poison.

Psychic causes which are connected with the specific infection may produce mental disturbances in a brain whose blood and circulatory paths are already impaired.

Furthermore, one should consider whether long-continued mercurial treatment may be regarded as having a deleterious effect upon the brain by causing nutritional disturbances.

**Changes in the Blood.**—Virchow was one of the first to direct attention to the changes which occur in the blood as the result of syphilis. He demonstrated a diminution in the number of blood-corpuscles and an increase in the albuminous constituents. Martin and Hiller found that the number of red blood-cells was greatly reduced in the secondary stage, and that also independent of this there was a diminution in the amount of hæmoglobin. On the other hand, Anz found in addition to the decrease in the number of red cells an increase in the white corpuscles in the secondary stage, so that one can speak of a relative and absolute specific leucocytosis. Other changes in the white cells have also been determined, such as a decrease in the polynuclear leucocytes and an increase in the mononuclears and transitional cells.

An increase in the eosinophiles has likewise been noted.

All these changes are characteristic, in that they are produced by syphilis, that they appear only after the specific infection, and that they vary in intensity with the reappearance or disappearance of new secondary symptoms, and can be influenced and a normal condition restored by antispecific treatment.

The French were among the first to lay emphasis upon a syphilitic chlorosis which was not benefited by the customary administration of iron and other tonics, but yielded only to mercurial treatment.

This blood condition may manifest itself before the outbreak of the first eruption, or during the second incubation period, and Stille has found it even at the time of the primary lesion.

**Dyscrasia as a Result of Antispecific Therapy.**—It must be acknowledged that the blood dyscrasia sometimes is produced by too frequently repeated and too prolonged courses of mercury and iodid. In such cases we have an artificially created toxic dyscrasia. Patients behave very differently in regard to mercury and potassium iodid. Some can take large doses of both for a long time and show improvement in their blood and nutrition, others are able to tolerate these drugs only for a certain time, and still others manifest an idiosyncrasy from the very beginning against antispecific therapy. For this reason it not infrequently happens that it becomes necessary for one to pause and consider whether the existing dyscrasia and state of poor nutrition are caused by the syphilis or by the antispecific treatment.

**Disease of the Blood Channels.**—The blood channels, as has been stated before, may likewise suffer in brain syphilis. Secondarily also the intra- and extravascular lymph spaces, and by chronic inflammatory disease of the leptomeninges and the consequent influence of the relationship between the intracerebral lymph channels with the epicerebral space, a disturbance of the permeability of the lymph channels in the entire brain may result. In this way the exchange between the lymph and the blood is retarded, and sometimes prevented, so that by the retardation of both the removal and replacement of the waste products of metabolism a disturbance of the nutrition of the nervous elements takes place.

**The Influence of the Infection Itself upon the Mental Condition.**—The specific infection may often be regarded as a psychic trauma, as in the etiology of every mental affection,

sorrow, care, anxiety, and fright play an important rôle; so the depressing influences attending an infection of syphilis should be considered as important in the causation of the mental disturbances following, in so far as they are not due to organic changes.

**Native Resistance of the Person Infected.**—Binswanger, as well as other authors, has repeatedly stated that it depends very much upon the vitality of the patient as to whether certain injuries of the nervous system will produce a functional or organic psychosis. Accordingly as the individual resistance of the nerve-cell itself, through impairment of nutrition or psychic trauma, is affected; if only the Nissl bodies, which are thought at the present time to represent the nourishing substance of the cell, and which after great destruction may be again replaced, are affected, or if the function-producing elements of the cells are damaged in an irreparable way. In the first instance we would have the picture of a simple exhaustion which is capable of reparation, in the second that of the progressive organic psychosis.

**Functional Nervousness.**—One observes not infrequently that hitherto healthy persons, after a luetic infection, exhibit symptoms of general nervousness. They lose their steadiness in thinking and accomplishing, are irritable, their sleep is disturbed. They complain often of rheumatoid indefinite pains, which are localized sometimes in one place and sometimes in another. Accompanying these symptoms is a feeling of pressure on the head. We may regard such a condition either as the consequence of the above-described blood alteration, or as the expression of the slowly-developing changes in the arteries and the resulting diminution in the blood supply to the nerve substance, or as the precursory symptoms of a paresis. Fournier and Lang have stated that this vague nervousness in luetic patients is to be regarded as the most frequent clinical expression of a meningeal irritation. However that may be, the fact remains that such conditions often, under antispecific therapy, disappear without the appearance of any other symptoms of syphilis.



**Cerebral Neurasthenia.**—Cerebral neurasthenia comes next for our consideration. The chief etiological factors standing in causal relationship to cerebral neurasthenia or psychasthenia inluetics are the shock of the infection itself, combined with the general disturbances of nutrition, alcoholic excesses, an inherited lessened resistance of the nerve-cell, and prolonged mercurial therapy.

The affection in syphilitics does not differ from a psychasthenia in non-syphilitics. Antispecific treatment in some instances—not in all, however—combined with general constructive measures, has seemed to me to produce a quicker effect than we are accustomed to see otherwise in this class of cases in non-luetics.

The following case of cerebral neurasthenia corroborates this fact:

A gentleman, forty-five years old, who ten years before had contracted syphilis, had complained for a long time of pressure on the head, difficulty in concentrating his mind on his work, feelings of apprehension, and a sense of oppression in the breast. He was also easily exhausted by every attempt at physical and mental exertion. He had taken a number of courses of treatment in hydrotherapy and diet, also psychotherapy, without result. A six weeks' course of inunctions with potassium iodid brought about a wonderful improvement without any other treatment and without any interference with his occupation.

Neurasthenia inluetics is most apt to appear during the secondary stage. In the differential diagnosis between simple nervousness and neurasthenia in patients who have had syphilis and beginning paresis, the four reactions must be regarded as of the utmost importance.

**Hysteria.**—Hysteria is also not infrequently observed in syphilitics. Charcot regards lues with reference to hysteria as analogous to other poisons, especially to the lead-alcohol-arsenic intoxications. Likewise, as in other organic brain and spinal-cord lesions, so in specific disease of the nervous system hysteria may be an accompanying symptom.

One occasionally sees patients who have become cachectic through a prolonged mercurial treatment develop hys-

terical symptoms. In order to attribute the hysteria to syphilis it is necessary that the patients before their infection have never exhibited any symptoms of hysteria, also that the hysteria develops during the time of the syphilis and can be either improved or cured by antispecific treatment.

In the diagnosis of hysteria, however, great caution is necessary, to which Wunderlich, Wagner, and Heubner have repeatedly called attention.

The symptoms produced by the specific organic changes in the brain are often so transient in character, and come and go so quickly, that the mistake is frequently made of diagnosing them as hysterical.

The following case illustrates the relationship existing between syphilis and hysteria:

A lady, thirty-eight years old, who had never manifested the slightest symptoms of nervousness or hysteria, six months after a syphilitic infection developed a typical hysteria major which proved refractory to the rest cure and hydrotherapy, but responded splendidly to mercurial treatment. The hysteria has never returned to the patient, although she has since undergone a great deal of mental strain and sorrow.

All observers agree that in so far as the clinical picture is concerned hysteria in syphilis does not differ in any way from the ordinary forms of the disease.

**Chorea.**—Concerning the relationship between chorea and syphilis, only a few cases have been reported. Zambaco has described a case in which the chorea developed in a previously healthy person without any other assignable cause, and yielded promptly to antisiphilitic treatment after other non-specific therapy had been tried without result. Kowalewsky has reported a family in which all the children of a syphilitic father suffered with chorea. Mayerhofer, Salinger, and, recently, Germanus Flatau also have reported cases which one must consider as syphilitic chorea.

**Epilepsy.**—Epilepsy, on the contrary, stands in close relationship to a specific infection. In speaking of epilepsy

here, those cases of symptomatic epilepsy which have been referred to before, as well as the cases of partial and general epileptic convulsions, which are the precursors of later-developing severe organic brain syphilis, and the epileptic attacks which sometimes occur as the first serious expression of a general paresis, are excluded.

This is the kind of epilepsy which cannot be distinguished from the idiopathic form. Fournier especially has directed our attention to this type, and every one who has seen many cases of epilepsy knows that frequently a syphilitic infection stands alone as the only etiological factor.

This parasyphilitic epilepsy occurs often in persons where the specific infection took place many years ago, but also, sometimes, is found in the earlier stages of the disease. The attacks appear, in general, less often than in the ordinary epilepsy, the intelligence is also apt to be less affected than in idiopathic epilepsy, and in a few cases the response to active specific treatment is good.

Slight attacks of petit-mal sometimes occur in between the severe attacks. These postsyphilitic epileptic neuroses may be differentiated from the specific organic forms, in that they do not resemble the character of a cortical epilepsy, are not accompanied by other cerebral phenomena, may persist for a long time without changing their character, and also by the fact that the effect of antispecific treatment on them is uncertain.

Vogt and Binswanger regard this form of epilepsy as due to the strengthening of a hereditary epileptic tendency by lues, and the awakening of a latent epileptic predisposition through acquired syphilis. Both of these authorities consider this form of epilepsy to be of rare occurrence. In my own experience I have had the opportunity of observing up to 1902 twelve cases. In all of these the history of infection was well established, there was no inherited tendency, no head injury, and no history of the use of alcohol. The attacks appeared quite regularly at intervals varying from two to six months. There were no intercurrent psychic anomalies in any of the cases. In all of them repeated treatment with mercury, and especially potassium

iodid, was without influence. In one case the specific infection dated back six months, in two, one year, and in one case each, five, seven, and twelve years respectively.

Such cases may properly be regarded as the expression of a cerebral poisoning without any demonstrable lesion of the brain.

**Hypochondria.**—One also finds in syphilitics hypochondria. In its simplest forms it is a well-expressed syphilophobia. The patients perceive in every sensation of discomfort, of transient headache, of forgetfulness of a word or promise or conversation the beginning symptoms of brain softening. They think they have discovered symptoms of syphilis on their bodies, they observe with a morbid conscientiousness all of their physical functions, and become, through increasing complaints concerning their mental and physical condition, a nuisance to those with whom they come in contact.

Such cases are not infrequent and occur almost always among the educated classes. This is a field for the highest skill of the physician. On the one hand, the thoughts of the patients must be diverted from their disease and its consequences; on the other, the ensemble of the case may require energetic and repeated antispecific therapy.

In severe cases one finds hypochondriacal paranoic interpretations of organic sensations and well-expressed hypochondriacal compulsory ideas, which I have observed in three cases to degenerate into severe paranoia hypochondriaca.

These conditions present nothing which in themselves are characteristic, because they are also found in persons who have never had syphilis. One of these cases of syphilophobia came under my care some time ago. All efforts made to build up the nervous system through tonics, hydrotherapy, and psychotherapy were not successful, but a course of anti-specific treatment brought about a very satisfactory result.

The frequency of hypochondriacal states and hypochondriacal mental disturbances in syphilitics has long been known.



**Melancholia.**—This hypochondriacal mood sometimes develops into a true melancholia. All observers agree that of the pure disturbances of the emotions in syphilis melancholia is the most frequent. The melancholia may manifest itself at first as a simple depression and then pass through all the grades to the most severe forms with compulsory suicidal impulses.

In the clinical picture presented there is nothing which is characteristic of syphilis. There is no such an entity as a syphilitic melancholia. We only know that it may develop in any of the stages of syphilis and also long after all tangible forms of the disease have passed away. However, one quite often sees the melancholia in syphilis disappear under antispecific therapy.

**Mania.**—Mania also occurs in syphilitics who otherwise do not show any evidences of the disease, and who have a good nervous inheritance and are without a previous history of maniacal attacks.

Attacks of maniacal excitement, however, in organic specific brain affections are much more often observed, whether the disease is one of the convexity, base, or a general syphilitic arteritic disease.

I have observed typical maniacal attacks in two cases with symptoms of a basilar gummatous meningitis. The mania manifested itself in an intense restlessness, a typical flood of ideas without evidence of mental feebleness, an exaggerated self-consciousness, and strong animal desires.

The following case is one of severe mania, ending in death:

The specific infection dated back two years. The patient was a sober and industrious young man. Without any apparent cause he developed a condition of exhilaration which rest in bed did not relieve. The exalted state soon passed into one of a typical mania, which made it necessary to transfer him to the hospital. Here the maniacal condition increased in intensity and was accompanied by an increasing stream of ideas on the grandiose order. After four days in the hospital the patient became disoriented and confused. He refused nourishment and had to be tube-fed.

He grew rapidly worse and died ten days from the beginning of his sickness.

At the autopsy the internal organs were found to be normal. Macroscopically the brain also appeared normal, except for a general hyperæmia. The microscopic examination showed the capillaries to be overdistended with blood, with extensive perivascular cell infiltration and cellular clumps in the nerve substance. No anomalies of the ganglion cells or of the glia were discovered.

In maniacal attacks in syphilitics one should always keep in mind the possibility that they may be the first warnings of a beginning paresis. Usually, however, by the observation of organic symptoms, and especially by the demonstration of mental and moral delinquencies, one is able to detect in the patient the paresis which had remained latent up to the time of the maniacal outbreak. Such cases are inclined to run a very acute course, even what might be called "galloping" in character.

It may be pertinent to state here that the four reactions, even in the initial stages of paresis, are positive.

Recently A. Westphal has called attention to a psychic condition which is manifested by a permanent exalted hypomaniacal state, with exaggerated self-consciousness and various and changeable grandiose ideas. In spite of the loss of the pupil reflexes to light and increase of the tendon reflexes, Westphal assumes that these cases do not belong in the category of paresis while the change in personality is not marked enough and while no progressive dementia develops; also the powers of observation and speech remain intact. Westphal believes that minute changes in the brain, perhaps depending upon specific arterial disease, or upon the effect of a toxin causing nutritional disturbances in the nerve tissue, are responsible for these conditions.

**Manic-depressive Insanity.**—The circulatory type of psychosis, manic-depressive insanity, occurs likewise inluetics.

I wish to call attention here to two cases of this form of mental trouble, both of which presented pupil anomalies and symptoms of degeneration of the posterior column. These

objective symptoms in these cases did not indicate, as their subsequent history showed, general paresis, but simply after-effects of a former specific infection.

The first case was in a high official, fifty years old, who before his marriage had syphilis. He was especially gifted mentally and in his particular work had acquired considerable reputation. Six years ago he became hypomaniacal, then was quarrelsome and hard to get along with, then engaged in spasmodic schemes and combinations, then became lavish in spending money. As a result of contention with his superiors he lost his position. He had Argyll-Robertson pupils and loss of both knee reflexes, as well as zones of hypoaesthesia on the legs and feet.

My impression at this time was that he had paresis. In a few days his mental state changed entirely to one of depression. This continued for about six months, when an exalted condition again appeared. At the same time there existed true changes of character. The once sensitive, tactful man became brutal and reckless. He drank and cohabited to excess and bragged over his *liaisons*. We still thought the case one of paresis.

The case continued as one of an alternating manic-depressive psychosis. The patient lived eight years and was continually in either a maniacal or depressive state. Disturbances of intelligence, speech, or exalted delusive ideas never were manifested. The patient died with an intercurrent pneumonia. At the time of his death my diagnosis was that of manic-depressive insanity in a luetic, with abortive tabes.

The microscopical examination of the spinal cord revealed quite a well-advanced tabes. In the brain there were no paretic changes. The microscopical examination of the cortex in different areas showed simple changes in the walls of the arteries and in places increase of the glia.

Another case was in a man fifty-three years old. His specific infection dated back twenty years. He began six years ago to have maniacal attacks. The diagnosis of a typical paresis was made in a university clinic. This dis-

couraged him and plunged him into a depression which lasted a number of months and was followed by a severe exalted state.

I saw the patient in this exalted state, which bore a maniacal character. Objectively he had anisocoria and loss of the pupil reactions to light, along with active tendon reflexes. There was no disturbance of speech or symptoms of dementia. Since my first examination the patient has twice changed from depression to mania and mania to depression. No new organic symptoms have appeared, and there is still no decrease in the intelligence.

These two observations serve to prove that Thomsen's assertion that a case of manic-depressive insanity may resemble a paresis, except that the anamnesis and the presence or absence of physical symptoms determines the diagnosis, is not absolutely true.

**Paranoia.**—Paranoia has been observed in syphilitics, both as a primary psychosis and with the accompanying symptoms of specific organic brain disease. A genuine paranoia is, however, as Jolly has pointed out, a very rare specific psychosis. Jolly states that in the later stages of the dementia type of syphilis there is a tendency to certain delusions, but that these are not fixed and not systematized.

A merchant, twenty-four years old, who one and a half years previously had contracted syphilis, came under my care because of a severe specific paralysis of the cranial nerves. After a short period of excitement he exhibited for a period of two months systematized delusions of persecution. He thought that his bride had been infected with syphilis by the physician who was attending him, and for that reason the physician was trying to poison him by putting poison in his food and thus getting him out of the way. Under antispecific therapy the nerve paralysis and delusions gradually disappeared.

**Catatonia.**—I had never seen the condition of catatonia either in brain lues or in luetics until recently. A few months ago I saw this psychosis in a patient whose parents had before the conception of the patient acquired syphilis.



A. Westphal has, however, reported one case of catatonia which occurred during the course of a cerebral syphilis.

**Amentia.**—Amentia has been observed in syphilis. Jolly describes amentia as the chief representative of the intoxication psychoses. The entire inability of the patients to receive new impressions, the acute and complete loss of memory, the acute confusion with delirium, and the succession of hallucinations, are the important clinical features. As syphilis is a constitutional poison, it is to be expected that this form of mental disturbance would occur.

It has been observed with and without pathological changes. It is often difficult to determine, because of the so-frequent occurrence, in the same patient, of chronic alcoholism and syphilis, how much to attribute to the one factor and how much to the other. The somatic symptoms of alcoholism, the general habitus, the characteristic motor unrest, changes in the internal organs which accompany chronic alcoholic intoxication, and, above all, the more acute and rapid course, with the more frequent tendency to recovery, are to be regarded as the deciding factors. It is important to remember that Korsakoff's psychosis, a psychosis often accompanied by a polyneuritis originating from an alcoholic basis, represents an acute amentia. This psychosis also frequently occurs in alcoholics. In nervous disease due to alcoholism, however, although the patient has had lues, the three reactions in the spinal fluid are negative.

**Dementia.**—Much more common than the amentia, and the most frequent form of mental disturbance in syphilis, is the dementia. Dementia as a result of syphilis may arise from different causes. It may develop as the termination of the functional psychoses, melancholia, mania, and paranoia, in dementia. Some authors regard the termination of these psychoses in dementia as characteristic of the specific psychosis. This view cannot be accepted, although it must be admitted that such an ending often occurs. Dementia also is caused by diffuse syphilitic brain disease. Its pathogenesis is then sometimes characterized by the apparently intoxicated and semiconscious condition described by Heubner.

There is, moreover, a primary dementia in syphilis, which is not a postsyphilitic dementia, as Krause has recently pointed out. This form of dementia is very difficult to differentiate from paresis, and not infrequently appears as a simple progressive dementia. It manifests itself either as a simple mental weakness, or develops more in the form of ethical defects, with a general blunting of the sensibilities and a tendency to roughness, lying, drunkenness, and extravagance. This type of dementia inluetics may be progressive or stationary, especially if specific therapy takes effect, and it may finally disappear, as I have seen it do. Nevertheless, cases of complete recovery are the exception. Usually defects in intelligence are left behind.

**Korsakoff's Symptom-complex.**—Korsakoff's symptom-complex has also been observed (Roemheld) in luetic patients. Typical cases of this form of mental disturbance, where alcohol could be definitely excluded, have been reported by numerous observers. Stransky has reported such a case in a woman who had also tabes and whose husband was affected with progressive paralysis. In this case the mental disturbance disappeared.

One should remember that the most varied forms of psychoses can occur in brain syphilis, and these forms do not necessarily mean an expression of general paresis.

**There is no Mental Disturbance Characteristic of Syphilis.**—Plaut in a recent work (1913) concerning the hallucinations of syphilis refers to the different paranoid forms of psychosis which not infrequently occur in tabes, although he expressly states that these paranoid psychoses can in no way be differentiated from those which occur in non-tabetic syphilitics. Otto Mayer, from a study of the material at the neurological clinic of the Berlin Charité, found that in cases of tabes, complicated with psychoses, disease of the cranial nerves (optic bulbomotor) occurred more frequently than in tabes cases without psychosis. Plaut divides hallucinations in syphilitics into three forms—acute, subacute and chronic. In the acute, one encounters conditions of excitement, without any essential disturbance of consciousness, delusions of persecution, illusions of hearing and

psychomotor excitement of a mild character. Recovery usually occurs. Neurological symptoms may be observed. The spinal fluid reactions are often positive.

In the chronic forms, there occur, also, genuine hallucinations of hearing, delusions of persecution, with preservation of consciousness. There is a well-defined feeling of illness. In the emotional sphere fear predominates, with well-ordered line of thought and absence of any decided mental feebleness. There is also an absence of any substantial disturbance of will power. Where the origin is subacute, the course is irregular. Specific therapy does not exert any influence on the course worth mentioning. The spinal fluid reactions are positive and neurological symptoms are sometimes present.

In regard to the question as to whether there is a type of mental disease which is characteristic of syphilis, the answer must be given in the negative. As Oebeke says, he has never recognized a pathognomonic luetic psychosis, a psychosis with characteristic symptoms and a well-marked course, and a favorable reaction to antispecific therapy. On the other hand, there is no type of mental disturbance, from the manifold symptoms of a general interference with the nutrition of the brain, on through the different forms of the functional psychoses, to the psychic symptoms exhibited as a consequence of local and diffuse organic brain disease, which may not be observed as the result of syphilis.

One may say in general, with reference to the establishing of a relationship between lues and mental disease, if other causes for the psychic disturbance are absent, such as heredity, psychic and physical trauma, alcoholism, debilitating bodily factors, or infection and intoxication of any kind, if antispecific treatment yields a more brilliant result, and if the mental disturbances are accompanied by other signs of syphilis in the body, then the presumption is to be regarded as greatly in favor of a specific origin.

It is worthy of mention here that a psychosis may develop during the administration of antispecific treatment, and that this fact, in itself, is no proof of the non-specific origin of the mental affection.

## IX

### DEMENTIA PARALYTICA AND SYPHILIS

In the second edition of this book, Nonne says with reference to this subject:

**Relationship of Dementia Paralytica to Syphilis.**—At the outset it may be stated that general paresis is not a specific syphilitic disease of the brain, but that the relationship existing between it and syphilis is manifold and intimate. At the present time the above statement does not entirely correspond with more recent observations. Since Noguchi, in April, 1913, announced the finding of the spirochæte *palida* in the brain of paretics, paresis must, strictly speaking, be enrolled under the category of brain syphilis. Paresis claims a right to particular attention, since it is increasing in a startling manner.

**Increase of Paresis.**—According to statistics of Althaus, taken from the insane hospitals of England during the years 1838–40, 12.6 per cent. of the patients admitted were paretics. On the other hand, statistics from the same institution during the years 1869–91 give the average number of paretics as 18.1 per cent., while the increase in all other mental diseases was only 0.2 per cent. In the insane hospital at Deggendorf, in Bavaria, during the years 1867–74 the percentage of paretics in men was 9.3, in women 5.2, while from 1885–90 the percentage of cases in men was 23.2 and 9.3 in women. In Berlin 34.6 per cent. of the cases were in men and 17.5 per cent. in women; in Munich 36.3 per cent. in men and 12.2 per cent. in women; in Budapest 36.5 per cent. in men and 7.5 per cent. in women.

**Earlier Development of Paresis.**—An important fact for the clinician to keep in mind is that paresis, at the present time, may develop comparatively early in life. Cameil, in



statistics collected from a series of cases in 1828, found the average age for the appearance of the disease in these cases was 44 years, while in the statistics of Regis and Kaes the average age was 38.

**The Increase among Women.**—The frequency of the affection in women has also increased. Formerly, according to the admissions in the institutions for the insane, the ratio of frequency between men and women was 8 to 1. In 1880 Reinhardt, at Friedrichsberg, found the ratio to be 3.2 to 1; Alzheimer, in the Royal Psychiatric Clinic in Munich, for the years 1894 and 1895, almost 2 to 1. In France the ratio is 2.4 to 1.

**Other Causes of Paresis.**—The causes of this undoubted increase in paresis may be attributed to the increase in the factors which are in general injurious to the nervous system: the refinements of civilization, the increase in competition along all lines, the greater consumption of alcohol, and the pursuit of pleasure of all kinds. Alzheimer considers alcoholism of first importance in accounting for the growth of paresis among the women in Bavaria.

One may also explain from these etiological factors the further facts that general paresis is a disease which attacks an individual during the best years of his life (between thirty-five and fifty), that it occurs more often in the cities than in the country, and that it seldom occurs among the women of the higher classes.

**Syphilis.**—The honor of having first discussed the relationship between syphilis and general paresis belongs to Esmarch and Jessen. Both of these observers reported, in 1857, three cases of paresis and syphilis in which they attributed the paresis as due to the syphilis. So the discussion of the question was opened, and it was demonstrated, as we shall see later in the consideration of tabes, that statistics have not furnished a firm foundation for definite conclusions, as the observations of different authorities led to different results.

**Statistics.**—It is not necessary here to present the great mass of statistics on this subject. The degree of their variation has been great. Eickholt, for example, found a history

of syphilis in only 11 per cent. of his cases of general paresis, while, on the other hand, Regis discovered a specific history in 94 per cent. of his cases.

The statistics of Rieger are probably the most comprehensive on the subject, and permit one to form as definite an opinion as one ever can from statistics alone. Rieger collected the statistics from eleven reliable and experienced observers, and ascertained in this way that in 1000 cases of paresis, syphilis was present in the history of about 40 per cent. of the cases, and in 1000 cases of patients with other mental diseases syphilis was present in the history in about 4 per cent. of the cases.

Krafft-Ebing has collected some other clinical observations from the literature, which are also pertinent to this subject.

Blaschko found that in Denmark the ratio of syphilis between men and women was 4.1 to 1—the same ratio that exists between male and female paretics; also that approximately the same ratio of frequency between syphilis in the cities and in the country exists between paresis in the city and country. It has also been proven that in countries where syphilis is prevalent, such as Roumania for instance, paresis is also common; and *vice versa*, in countries where syphilis is rarely found, as in some of the Swiss cantons, paresis is rare.

On the other hand, as is well known, in Turkey, where syphilis is common, there is little general paresis. Kraepelin and others have proven, by their studies in lower India, that among the native population paresis did not occur; while syphilis was by no means lacking. Kraepelin explained the cause of this as either due to race peculiarities, or to harmful factors which rendered Europeans less resistant to the effects of syphilis on the brain and cerebral vessels than the natives. The same disproportion exists between syphilis and paresis in Algiers, China, Japan, and Abyssinia.

Perhaps the explanation of the reason why paresis occurs so rarely in women of the higher classes lies more in the fact that they are not compelled to enter into the

struggle of life than that syphilis rarely occurs among them.

A further fact which is also true in tabes is that certain classes which are particularly exposed to venereal infection, as sailors, officers, and commercial travellers, more often develop paresis; while, on the other hand, the clergy, in whom venereal infection is unusually rare, very seldom are affected with paresis. Krafft-Ebing states that in 3000 cases of paresis in men there was only one Catholic priest, and that this priest had been a syphilitic.

**Infantile and Juvenile Paresis.**—During the last decade the observations of the occurrence of paresis in children and youthful persons has greatly increased. This, however, does not mean that the juvenile type of paresis is on the increase, but rather that our attention, in recent years, has been more sharply drawn to this form of the disease, as a result of which these cases become easier to recognize. In the numerous cases of infantile and juvenile paresis reported the cases in which syphilis in the parents was not proven have been very few.

The following case is extremely pertinent here:

A woman, twenty-nine years old, came under my care at the Eppendorf Hospital with general paresis. There was not the slightest evidence that she had ever had syphilis, she was *virgo intacta*, and for the assumption of an extragenital infection nothing was found. The history obtained from the mother was as follows: The patient was nursed, together with another child, by the mother. This child died two months later with syphilis, after the mother had been infected with a breast chancre. From this breast chancre the mother infected the patient. Her father was likewise infected by the mother, and now after twenty-nine years the father is tabetic, the mother has symptoms which are suspicious of paresis, and our patient has typical paresis.

In yet another category of cases of infantile paresis we find a combination of different etiological factors, such as bad heredity, the use of alcohol in one or both parents, and the bringing up in a bad social environment.

Alzheimer found in cases of infantile and juvenile

paresis syphilis in the history of 91 per cent. of the cases, Fournier and Krafft-Ebing in 100 per cent.

Fournier has particularly brought out, in contradistinction to other observers, that in his cases the neuropathic heredity was not important. In 112 cases of paresis reported by him he was able to find a poor nervous inheritance in only two cases.

**Late Syphilis—Late Paresis.**—As in tabes, so it has also been observed in paresis that after a specific infection acquired late in life, the beginning of the paresis then occurs during the advanced years. A further analogy exists in the frequently-observed cases of paresis and tabes in husband and wife.

**Combination of Paresis and Syphilitic Brain Disease.**—As in tabes, so also in paresis, along with the paresis there is sometimes a true specific disease of the brain. One likewise encounters Heubner's arteritis in combination with paretic changes. A number of such cases have been reported, especially cases of infantile paresis which have developed from a hereditary specific basis, as in Heubner's case. In this case paresis and genuine syphilitic processes were coexistent.

At the present time it is largely a matter of personal opinion whether one considers that the pathological changes are caused by a postsyphilitic toxin, as Strumpell believes, or a fermentative poison, as Möbius says. Burns and Robertson assume that general paresis is caused by a toxin which is absorbed into the system from the alimentary tract.

**Krafft-Ebing's Experiments.**—Krafft-Ebing has endeavored to settle the question as to whether paresis is a consequence of syphilis, in an experimental manner. He selected nine paretics in whom neither in the history nor in the physical examination was it possible to obtain any evidences of a past syphilis. He vaccinated these patients both with the exudate from an initial lesion and the secretion from a mucous patch. The patients were kept under continuous observation for 80 days and not one of them reacted to the vaccination. In other words, in all of them there existed



apparently an immunity against syphilis. Since it is well known that immunity against syphilis exists only where there is inherited syphilis, or where there has been a previous syphilitic infection, it would seem to be proven that a former syphilis must have been present in these cases.

While most of the alienists, and especially those in Germany and Austria, assume a causal relationship between syphilis and paresis, this view is by no means universally accepted.

The existence of this relationship has recently obtained further support from the contributions of Neisser, Wassermann, and Plaut, in the examination of the blood and spinal fluid. This subject will be considered in a special chapter. It is only necessary to say here that there is no disease of the nervous system in which pleocytosis and increase of globulin in the spinal fluid and the complement deviation reaction, both in the blood and spinal fluid, occur so regularly as in paresis. Because of these new and important facts, the views of the opponents of the "no syphilis, no paresis" theory have at the present time only a historical interest.

Hirschl, as a result of his observations concerning the etiology of paresis, says there appears to him no longer any doubt, but that paresis should be regarded as a late effect of syphilis, an encephalitis syphilitica of the brain substance, finally ending in atrophica cerebri syphilitica. Raymond in the great discussion concerning paresis, in Paris, takes the same view-point, and Leredde, previous to 1908, had expressed the opinion with reference to both tabes and paresis, that they were pathological and clinical modalities of a nerve syphilis, the result of a slow progressive syphilitic process.

Kraepelin believes paresis to be the result of a poisoning and sees in this conception an explanation of the entire ensemble of the disease.

This authority explains metasyphilis as the result of a disease of metabolism which has originated through a long existing syphilis but is not directly a part of it; the disease of the circulatory apparatus, the kidneys, the variation in the body weight, the changes occurring in the blood in the

form of a decrease of erythrocytes and hæmoglobin, diminution of the lymphocytes, increase of the leucocytes, appearance of polynuclear blood-cells, raising of the lecithin content, increase of the fibrin content and decrease of the alkalescence, all speak in favor of a general disturbance of nutrition in paresis. This disturbance of metabolism produces the poison, which is to be regarded as the final cause of the parasyphilitic changes. The nature of this final cause is not as yet known. We know under certain conditions syphilitic disease of the thyroid gland can cause myxœdema, and so one can imagine that a specific disease of the glandular apparatus might bring about a disturbance in the bone-marrow. We see built upon the assumption of a secondary toxin influence, various theories with reference to parasyphilis. Mott explains the localization of paretic and tabetic disease by the peculiarity in the course of the pia veins, Schaffer by the difference in individual nervous systems, Edinger by an incapacity for certain requirements, Fleischig in the manner of their pathological development or through the intensity of the efforts required of them, as, for example, in mental efforts, the upper cortical layer in the frontal brain, or through heredity (Näcke, Raymond), racial disposition, climate, habits, especially in relationship to alcohol, to sexual life, cold and bodily exertions, a predisposition of this or that column area (certain parts of the brain in paresis, the Nageotte-Obersteiner-Redlich theory) or the spinal ganglia or the posterior columns in tabes, all have been drawn upon as explanations of metasyphilitic diseases.

In a more recent stage of our progress, the relationship of lues to tabes and paresis was seen in the proof of lymphocytosis (Ravaut, Sicard, Widal), increase of albumen (Guillain, Parinaud, Nissl), increase of globulin (Nonne, Apelt) in the so-called genuine specific diseases of the nervous system. These reactions did not differ greatly from those occurring in the so-called parasyphilitic diseases.

Further progress in the paresis, tabes, syphilis discussion was found in the discovery of the Wassermann reaction. This reaction was a great help in the lues anamnesis. Plaut soon published his statistics, where in one series in 159

paretics the Wassermann was 159 times positive, in another, in 183 cases, only negative once. In these same series history of lues was not obtainable in 22 per cent. of the men and 30 per cent. of the women. Since then, especially since the introduction of Hauptmann's Auswertungs method in the spinal fluid examinations, all observers have been able to obtain a positive Wassermann in both paresis and tabes in from 95 per cent. to 100 per cent. of the cases. In an extensive experience I have discovered that the cases of tabes in which one or all of the four reactions are negative, and such cases are not confined entirely to the "abgelaufene" type, are somewhat more frequent than I formerly supposed; also, by control examinations extending over a period of two years I have determined that the Wassermann reaction in the spinal fluid (even by 0.2 c.c.) in tabes does not mean either an already existing paresis or one in process of development. Further, occasionally in tabes, where the Wassermann in the spinal fluid was negative or where the Wassermann in the blood was negative and positive in the spinal fluid, a paresis may occur. Such cases are, however, rare exceptions. As a result of repeated examinations, I must take issue with Schoenhals, that only those cases of tabes remain stationary which show negative reactions. Five cases, three of which extend over three years and two over two years, justify me in this position. All have shown positive reactions over this period of time and yet remained in their clinical course absolutely stationary.

In general, one can at present say, as Möbius has categorically expressed it,—"*omnis tabes e lue.*"

The hæmolysin reaction of Weil and Kafka, which proves the passage of hæmolytic normal amboceptor into the spinal fluid, seems to indicate a difference between paresis and cerebrospinal lues. In regard to the different behavior of the cholesterin reaction of the spinal fluid in paresis, the observations are as yet incomplete.

The same may be said of Abderhalden's decomposition method, which has repeatedly shown that paresis decomposes more organs than cerebrospinal lues (in addition to brain and spinal cord, heart, kidneys, spleen, thyroid).

Is paresis a typical disease?

If one asks the question as to whether paresis is a typical disease, typical in the sense that it is more typical than cerebral spinal syphilis, one must answer yes and no. Yes, because certain symptoms, such as the pupil anomalies, the speech disturbances, the increase of the tendon reflexes, almost always occur, and, also, yes, because a certain characteristic type very frequently presents itself. No, because the disease often shows a surprising variety of phases. The following recent classification of the different types illustrates this:

- 1, typical paresis.
- 2, Lissauer's focal paresis.
- 3, a typical paresis.
 

(a) catatonic	}	form.
(b) senile		
(c) fulminating		
- 4, stationary paresis.

A glance at this classification shows that not much which is "characteristic" is left.

However, every experienced physician at the present time knows the frequency of the abortive type (*formes frustes*), the healing with defect on the one hand, on the other, the type running a rapid course. Recently Jakob and Kafka, from material at the Hamburger Insane Hospital, at Friedrichsberg, have demonstrated how typical, clinically and serologically, paresis may be, and, on the other hand, how, clinically and serologically, typical cases microscopically may not conform to true paresis.

Each one of us knows well those cases which begin clinically apparently as an arteritic or a meningitic form of cerebrospinal lues and later take the course of a typical paresis. The interval does not differentiate. One finds in the literature many cases of tabes and paresis which have developed within two or three years after the infection. I have observed one case in which the tabes developed  $1\frac{1}{2}$  years after the infection. Blümel reports one beginning one year afterwards; Schaffer one,  $1\frac{1}{2}$  years after. Recently Frey has observed two cases in which tabetic symptoms



appeared three and four months after the infection. In August, 1913, Förster (Breslau) announced in London that he not infrequently saw cases of pupillary anomalies and paralytic symptoms, during the early part of the secondary stage, which responded to specific therapy. On the other hand, there are also many cases in which the lues cerebri appeared many years after the infection. The longest interval observed by me was 30 years. This case was controlled by autopsy. In the majority of cases of paresis and tabes we may assume that they have existed for a longer period before they consulted a physician than is the case in lues cerebrospinalis, which more often begins with alarming symptoms and compels the patient to seek medical aid at the start.

**Specific Therapy.**—Formerly another important point of difference between lues nervosa and parasyphilis was thought to be the failure of therapy in the latter. We know that in the arteritic form of brain and spinal cord syphilis specific therapy fails because, through the narrowing and displacement of the vessel lumina, secondarily created softenings and necroses remain uninfluenced and improvement can only occur through the aid of collaterals. We know, also, that gummatous processes only yield to specific therapy when tissue capable of absorption is present and that older gummata, which also contain spirochætes, remain often refractory to antispecific means. Erb, with his large experience, has recently emphasized the necessity of specific therapy in tabes. Raymond, Leredde, Steyerthal, Dreyfus and Fr. Schultze have observed cases of paresis which remained practically well for years. I can report not fewer than four cases of uni- and bilateral loss of the pupil reaction to light, which disappeared under specific treatment and at the same time all the four reactions became negative. One of these cases was presented by me at the meeting of German neurologists held in Hamburg in 1912. If these were incipient cases of tabes and paresis, we can no longer say that these diseases do not respond to specific therapy. The observations of Alzheimer show that in paresis and tabes the lymphocytes and plasma cells, contrary to their

behavior in other specific nervous disease, do not wander outside of the lymph spaces. In this incomplete reaction of the nerve tissue against the spirochætes may lie the explanation of the helplessness of the system against these parasites in tabes and paresis. One cannot at present regard the influence of therapy as constituting any essential difference between lues and metalues of the nervous system.

**Pathology.**—What has the pathology taught us in recent years with reference to this question? Above all one is more and more convinced that the pathology ofluetie disease is not sufficient for the determination of itsluetie nature. Schmauss, Erb, Oppenheim, Kahane, Nonne and others say that only the whole picture (combinations, absence of other diseases) makes possible a decision. It is recognized that there are pathological changes which are not specifically syphilitic in nature and yet are caused by syphilis. Pathological and experimental observations demonstrate that bacterial poison even without the causation of inflammatory changes, as well as chemical poisons, can cause primary sclerosis of the arteries. Simmonds assumes the action of the poison of syphilis upon the veins as the causative factor of phlebosclerosis. The pathological peculiarities of paresis as taught by Nissl and Alzheimer cannot at the present time be regarded as correct. Nissl himself says, that all the minutiae which one finds in paresis, in the cells, the blood-vessels, the pia, also may occur in other forms of disease. Only the ensemble in the pathological picture, the wide distribution and high degree of new vessel formation, the extensive distribution of severe disease of the cellular elements and severe fibre atrophy, the localization of the glia proliferation predominantly in the deep cortical layers, the disturbance of the cell arrangement, the predilection of the plasma cells and lymphocytes for the vessel sheaths, the more frequent involvement of the frontal brain with relative absence of involvement of the posterior lobes, permit the diagnosis of general paresis.

Ever since Obersteiner in his monograph in 1908 emphasized this point, it has gradually become plainer that in

paresis the disease of the nervous system is a general one. The medullary layer, the large ganglia, the cerebellum and spinal cord and the peripheral nerves, all may be involved. We must also admit that all the pathological findings in paresis, taken in detail, do not show any essential difference from the pathology of other syphilitic nervous diseases. It has also been demonstrated that other organs, especially the glandular (liver, spleen, kidneys, ovaries, thyroid), show severe inflammatory changes in paresis.

The observations of Steiner are interesting. This investigator has carefully examined sections of the peripheral nerves in paresis and tabes, stained according to modern methods. He has been able to demonstrate on peripheral nerves all over the body, inflammatory, that is proliferating, tissue processes in both affections.

**Occurrence of Luetic Disease in the Families of Paretics.**—Plaut and Göring, from an observation of 54 families, were able to find either positive or very probable evidence of very specific disease in about one-third of the children and in 32.6 per cent. of the consorts the W.R. in the blood. In only 38 per cent. of the cases was there no evidence of an infection in any member of the family. It has been recognized for a long time that lues may continue infectious for very long periods. Fournier has published a case which was still contagious after thirteen years, Plaut and Göring one after eleven years, Delbanco one in which the wife was infected by her husband after fourteen years; Levig saw the birth of a still-born syphilitic foetus twenty years after the infection of the father. So far as my experience goes on this subject, one must regard the consort as infected in 64.6 per cent. of the cases if one considers the stigmata not only in the consort but in the children as well. This high percentage probably only represents the minimal, since I have been unable in all the families to examine all of the members.

An infection may occur without a primary lesion.

Such a case I observed in a patient who was engaged in working in a hospital. Shortly after an operation on a syphilitic he stuck his finger with a needle which had been

used in the operation. A primary lesion notwithstanding the most careful observation was not found. After two months a roseola and mucous patches, and inside of three years the first symptoms of tabes dorsalis appeared. I am convinced that many of the cases, in which the wife becomes tabetic, without ever having observed a primary lesion, belong in this category. One must at the present time assume that through coitus itself, although there is no specific disease of the genitals, syphilis may be transmitted. It is possible that the spermatozoa are loaded with the specific virus. Uhlenhuth and Mulzer have been able with the semen of a syphilitic, by injection into the testicles, to infect a rabbit.

**Noguchi's Demonstration of the Spirochæta Pallida in Paresis.**—Noguchi, in seventy cases of paresis, which he examined with Moore, was able to find the spirochæta twelve times. In a later publication he was able to announce a positive finding 48 times in 200 cases. These cases were both clinically and pathologically, typically paresis. In regard to the microscopical diagnosis, Ranke, who, with Nissl, had an opportunity of examining Noguchi's preparations, in a communication to me concerning them said: "Since the pathological changes are diffuse in character, show no focal nature, the histological diagnosis of paretic disease of the cortex may be positively made."

**Corroborations:** Later Noguchi was able to show the spirochæta in the dark field from a specimen taken from a fresh paretic brain. According to Noguchi, Moore was able, also, to demonstrate the spirochæta in paresis according to the Levaditi method. Repeated confirmation of Noguchi's finding has been made by independent observers in all parts of the world. Förster and Tomaczewski, by means of the Neisser method of brain puncture *intra vitam*, succeeded in obtaining smear preparations and demonstrating in them the spirochæta. Observations thus far would seem to indicate that the spirochætes are more abundant in the cases of paresis running an acute course than in the cases of a chronic type. However, a definite ratio between the abundance of the spirochætes and the rapidity of the course does not



exist. The spirochætes are found in all layers of the cortex. They also occur in the medullary substance. They do not show any special relationship to the blood-vessels, not being particularly frequent in the vessel sheaths. In general it can be said that the distribution of the spirochætes is a diffuse one. They are found free in the tissue but show an inclination for the nerve cells with consequent damage to the same.

Recently Noguchi has succeeded in infecting the testicles of a rabbit specifically, from nerve tissue taken from the brain of a paretic. Graves (St. Louis), with blood in one instance taken from a case of taboparesis, in another from a case of incipient paresis, by inoculation into the testicles of rabbits, was able to render the animals syphilitic. In these rabbits so inoculated there developed a primary lesion and subsequent secondary symptoms. By puncture of the testicle in one case, Graves was able to demonstrate spirochætes in abundance and with these spirochætes to again infect other rabbits and cause in them both primary and secondary symptoms. These spirochætes were acknowledged by Noguchi as the *Spirochæta pallida*. Frühwald reported in the *Münch. med. Wochenschr.*, 1913, Nr. 44, S. 248, that he was able in three cases of latent syphilis to find the spirochætes in the blood, although the Wassermann in the blood was negative.

A positive inoculation by means of the spinal fluid taken from a case of paresis has thus far not been successful.

Since successful inoculations with portions of paretics' brains have so seldom occurred, it is possible to attribute the failures to a weakened form of the parasites in both tabes and paresis. In this weakened state, with the same morphological identity, the *Spirochæta pallida* must be able to produce such pathological changes as occur in these diseases. The question now is, whether the discovery of Noguchi has essentially changed our conception of the nervous diseases hitherto designated as metalues.

Both of these questions should at the present time be answered in the affirmative. It may be said with certainty that neither paresis nor tabes is a sequela of syphilis but

that these diseases are caused by the toxic action of the living spirochætes present and active in the nervous system.

One understands at present that paresis is a disease of the entire nervous system, also that tabes may be called a paresis of the spinal cord, that it is in reality a paresis with only a different localization.

Two other questions become pertinent here. Is there a peculiar species of the *Spirochæta pallida* which shows a particular affinity for the nervous system, or, from another point of view, are there individuals whose nervous systems are especially vulnerable to the entrance of this organism?

For the assumption of a special type of spirochætes we have at present no proof. It is reasonable to suppose that there are particular strains of spirochætes whose toxic effect upon the nervous system is above the average. In other infectious diseases, in different epidemics, often a certain predilection is manifested for disease of this or that organ. The observations of Dörflin show as a matter of fact that there are different biological types of spirochætes, that intermittent fever in Europe, North America, East and West Africa, has special characteristics, while the different spirochætes are morphologically apparently identical but may be distinguished by their different immunity reaction, since different animal species in varying degree are sensitive to them.

In regard to a special predisposition of certain nervous systems, contrary to Näcke and his adherents we may conclude at present that the neuropathic disposition is not an important factor, and, also, contrary to Kraepelin that alcohol is not. We may, also, conclude that physical and psychic trauma is not important, that physical exertion, cold, hygienic errors have been greatly overestimated, that climate, the youth or age of nations, as well as the immunity of certain races as important factors are to be considered with caution. In this connection, the published observations of Steiner (Wollenberg's clinic in Strasburg concerning the behavior of the brain and spinal cord in syphilis in rabbits experimentally produced) are interesting. The nervous system was only affected in a few of these cases, in

some the spinal cord only, in others both spinal cord and brain. Steiner also calls attention to certain lesions which bear a similarity to the histological characteristics occurring in metasymphilis. This tends to prove that syphilitic tissue processes in many particulars can take on absolutely the picture of the tissue changes which have been recognized as characteristic for metasymphilis. Steiner also says that a differentiation between syphilitic and metasymphilitic processes in detail is often not possible. On the other hand, he emphasizes the fact that a primary degenerative process independent of genuine inflammatory processes, as it exists along with true inflammatory processes in metasymphilis in the experimental syphilis of the rabbits, was not observed.

**Intoxication Theory.**—Now, as formerly, without the assumption of a poison, which in a series of cases is produced in irregular intervals and injures the nervous system, are we able to explain tabes and paresis. The progressiveness of the course in many cases, the periods of remission and exacerbation, the crises, necessitate such an assumption; also, the assumption of a spirochaetic toxin that has a particular affinity for certain tracts explain best why in tabes certain neurones (sensory-coördination-optic pupil sympathetic neurones) are involved. In paresis the assumption of an intermittent production of poison on the part of the spirochaetes permits an explanation of the paralytic attacks.

It is understandable that a toxin might have a special predilection for certain parts of the brain (frontal lobes), also it best explains the inconsistency so often observed between the pathological findings and the severity of the clinical symptoms. If we consider a paretic, who has enjoyed a long remission after a severe course of the disease, then again suddenly relapses, the improbability of any essential change in the pathology of the brain in the interval shows that intoxication factors must play an important part in paresis. Finally by the assumption of a poison, the peculiarity of the pathology, that is, the primary degeneration, together with the genuine inflammatory processes, are more rationally explainable.

**Difference between Syphilis and Parasymphilis.**—Head, as

well as Mott, arrive, although in different ways, at the same conclusion. Head, with his co-workers (McIntosh, Fieldes, Fearnside), says: The clinical manifestations of parasymphilis are an expression of the reaction and necrosis of hypersensitized areas of the nervous system, evoked by the reappearance of the *Spirochæta pallida*. This means that in the earlier stages of the disease the tissues have suffered a change of such a nature that to fewer members of spirochæta or smaller doses of their poison they react more severely.

Mott assumes that the neuroglia and blood-vessels become affected secondarily and that this secondary disease is caused by the irritation of the primary necroses on the nerve substance. The fact is, that in tabes and paresis no migration of lymphocytes and plasma cells occurs in the tissue and that the spirochætes lie in fully reactionless tissue. The infiltrate in tabes and paresis in contradistinction to cerebrospinal lues does not leave the lymph spaces. It has been clearly demonstrated, first by Nissl and Alzheimer, that, along with the inflammatory changes in paresis, there is a primary degenerative process of the nervous elements and up to the present time no reason has been forthcoming for considering the inflammatory condition as a result of the primary degenerative processes.

The great variation in the clinical types of paresis is an argument in support of the contention that it is "something in itself different." The long remissions and clinical improvements which occur often without the aid of any therapy stand in contradistinction to the course of a true cerebrospinal lues, which is not often subject to marked and lasting variations without the aid of specific therapy.

**The Frequency of Paresis in Syphilis Infection.**—Matthes has followed the course of all the persons treated for syphilis at the clinic at Jena during the last twenty years. He found that of all the male syphilitics (568) only six had developed paresis. The statistics which represent the largest material were collected by Mattauschek and Pilez. They found among 4134 officers who were syphilitic, 159 cases of paresis—4.79 per cent. From the same material, these observers found



the percentage for tabes 2.73. All who have investigated statistics agree that paresis occurs more often than tabes.

**Differential Diagnosis.**—The differential diagnosis of dementia paralytica is of the greatest practical importance. It is often difficult to distinguish it from a number of brain affections.

**Diffuse Syphilitic Meningitis.**—In the first place, the diffuse meningeal form of syphilis must be differentiated from it. In both affections the patients often complain, for a long time, of headache and dizziness, weakness of mental activity, and loss of memory. Transient paralysis of the cranial nerves and the extremities may occur in both. Symptoms which speak for the diffuse meningeal form of syphilis are well-marked sensitiveness of the skull to percussion, long-existing paralysis of the basilar cranial nerves, which yield to antispecific therapy, and the presence of disease of the optic nerve. Psychic disturbances which are either acute or chronic in form may be observed in both conditions; in the diffuse meningitic type of lues, however, they usually appear more in the form of a gradually-increasing apathy, which may lead to dementia, while in paresis, frequently symptoms of irritation in the form of psychic irritability, depressing and maniacal delusions, which may develop to a state of maniacal excitement, are observed.

In rare instances the poisoning of the brain by the meningitic form of lues may produce similar psychic anomalies to those which are regarded as characteristic of paresis.

**The Arteritic Form of Brain Syphilis.**—The endarteritic form of brain syphilis manifests itself usually in hemiparetic and paralytic conditions, and the psychic disturbances appear more as a clouding of the consciousness, a semilucid condition, than as symptoms of psychic irritation and weakness. The endarteritic form may, after many years, end in paresis.

The following is a case of endarteritis luetica, with later an acute paresis:

A man, fifty years of age, fifteen years before had contracted lues. For three years he had complained of weakness of memory and inability to think, as well as attacks of

dizziness. Objectively his capacity for work was diminished, likewise his ability for logical reasoning and his memory for recent events. There was also a slight disturbance in his articulation, and he had Argyll-Robertson pupils on both sides. Six months later he developed a hemiparesis on the left side, which disappeared in two weeks. Under combined treatment of mercury and iodide the disturbance of speech cleared up and the mental condition improved so much that his family considered him entirely well. The condition of the pupils remained unchanged. He returned to his business and conducted it in a wholly satisfactory manner for two years. Then, in order to tone himself up a little, he went to a foreign water-cure. Here he developed insomnia, was for a few days slightly depressed, and then suddenly went into a state of wild hallucination, delirium with grandiose ideas, and rapid mental prostration, from which he died in four weeks.

In the differential diagnosis between specific cerebral disease and paresis there are many factors which render the question difficult. In the first place, there is no doubt that the so-called classical form of paresis, which begins with maniacal or depressive symptoms and quickly attains to severe defects of the intelligence and memory, causes the dissolution of the entire psychic personality under the picture of feeble-minded ideas of grandeur and finally imbecility, at the present time is less frequent, and the simple dementia form without the classical stigmata has become more frequent.

Secondly, the specific diffuse cerebral syphilis may present the picture of a simple progressive dementia, or it may exhibit a variety of forms and degrees of manic and depressive excitement for longer or shorter periods.

Thirdly, in both diffuse cerebral syphilis and paresis there occur apoplectiform attacks with transitory paralyses.

The difficulties of a differential diagnosis are recognized by all who have made a special study of paresis and brain lues. Oppenheim states that in two of his cases, where he made the diagnosis of paresis, the patients recovered to such an extent after antispecific therapy that this diagnosis was no longer tenable.

In this connection it might be again observed that paresis, with and without antispecific therapy, may show great improvement, both in the somatic and psychic symptoms, and that only those who have known the patient intimately are able to detect the intellectual and moral delinquencies. In such cases one must be prepared either for a gradual or sudden further exacerbation of the disease.

**Is 'Recovery in Paresis Possible?—**It had previously been considered that a genuine paresis is incurable, but this opinion cannot, at the present time, be unqualifiedly maintained. I know from many conversations with experienced physicians that the majority of them occasionally have observed the recovery of some case with the typical symptom-complex of paresis. Schüle has reported a case of undoubted paresis with recovery after an attack of double pneumonia and severe suppurative otitis media. This patient has remained well twenty years. Gaupp saw in Kraepelin's clinic, in Munich, cases of paresis with unusually long remissions. Halban has reported some cases of paresis with recovery. In one case the mental condition had remained normal eleven years, in another fifteen years, after presenting classical pictures of dementia paralytica. In nineteen years I have observed ten cases in which I believed recovery had occurred. From these ten cases, four must now be excluded because time has demonstrated that they were only cases of long remissions. Of the six remaining cases, two may be enrolled under syphilitic dementia, which leaves four cases of recovery in paresis.

Because of this great rarity, two of these cases are reported here.

The first case belonged to a taboparalytic family. The man contracted syphilis, infected his wife, who, after anti-specific treatment, bore a son. This son, when ten years old, developed brain syphilis, which left behind it pupil anomalies and feeble-mindedness. The wife developed a stationary tabes. The man himself, after a stage of excitement, was admitted into a private sanatorium, where he was enrolled as an undoubted case of dementia paralytica. He presented an excited state with some dementia and ideas of

grandeur. At the same time the light reaction of both pupils was lost, there were also slight difficulties of articulation, and the deep reflexes of the lower extremities were increased.

Against the advice of the physician, his wife took him home, where he gradually recovered so that at the end of a year he was able to again take up his business. He continued his business with good success for six years. Then one day he suddenly died of heart trouble. Of the somatic symptoms which remained during these six years there was only mydriasis and loss of the pupil reaction to light.

A gentleman, thirty-seven years old, came under my observation during the years of 1901 and 1902. He had always been healthy and had acquired syphilis six years previously. He had never been a drinker, had a good nervous inheritance and had suffered no injury to his head. For the space of a year his articulation had been poor. Two years before consulting me he had severe epileptic attacks in which he bit his tongue. During the last few months his speech became worse and his memory poor. He was irritable and easily excited to anger, whereas before he had been good-natured in disposition.

Objectively there was weakness in the right facial, tremor of the tongue, slight articulatory disturbances of the speech, the light reaction of the left pupil was lazy, and the deep reflexes of the lower extremities were active. The patient remained fourteen days in the hospital and then withdrew from further treatment. A year later he again entered the hospital because of severe headache, loss of memory, and a state of excitement. During the year's interval the patient had taken up his business, that of running a butcher shop, but in conducting the business he had to be governed by his wife, because he was not reliable.

Objectively there were again found weakness of the right facial, increased tendon reflexes, a slight difficulty in articulation, myosis and loss of the pupil reaction to light on both sides. Mentally there was a weakening of the intelligence and memory. During his six weeks' stay in the hospital the dementia progressed steadily. A course of



inunctions produced no change in either the subjective or objective symptoms. He was discharged with the diagnosis dementia paralytica. Six years later I had the opportunity of again seeing this patient, and found him mentally absolutely normal. I ascertained from his wife that he had remained mentally weak for about one year, that after this he gradually improved, and during the last five years had been able to manage his affairs fully as well as ever. Objectively the only physical anomalies left were the myosis and loss of the pupil reflexes to light.

These are cases whose enrolment under the diagnosis of dementia paralytica no one would have doubted if their termination had been the customary unfavorable one. The fact alone that the outcome was favorable, according to my opinion, should not change the diagnosis. We should consider it an obligation to report all such cases which come under our observation and possibly reconstruct our present opinion that all cases of general paresis are incurable. Those who believe in the absolute incurability of paresis will say that such cases were either cases of diffuse brain syphilis or that they presented unusually marked and long-continued remissions. Practically, however, these cases should teach us to be more cautious in our prognosis of paresis than formerly we were accustomed to be.

**Syphilitic Pseudoparesis.**—Concerning specific pseudoparesis, and whether one is justified in making a separate entity of this affection, much has been written. Fournier and his pupils were the first to describe this disease.

Fournier says that not infrequently after a luetic infection a symptom-complex develops which in the psychic sphere greatly resembles paresis, with the features of dementia strongly marked. By antispecific therapy this condition disappears because the pathological basis of this symptom-complex is not one of a general process of degeneration as in paresis, but is caused by local, usually multiple and superficial, specific processes in the brain. It is said to be justifiable to diagnose this form of brain syphilis when the mental symptoms are combined with conditions of hemiparesis, hemiepilepsy, tremor of the extremities, and

irregular symptoms from the posterior columns. Especially useful in the assumption of a pseudoparesis syphilitica are paralyses of the internal and external eye muscles, disease of the optic nerve, and changes in the field of vision.

These cases are comparatively frequent and their early recognition is of great importance. Fournier's phraseology of pseudoparesis is, however, not generally accepted, because these cases are not cases of paresis but of brain syphilis.

Förster wishes to reserve the designation pseudoparesis for those rare cases which begin as classical paresis, and then either become quiescent or completely recover. The acceptance of the term pseudoparesis, according to Förster's limitation, has found the most favor in Germany.

The following is a case of pseudoparesis in the sense of Fournier:

A laborer, forty-three years old, had eighteen years before his present illness contracted syphilis. He had taken a number of inunction courses. Five years ago he had been treated in the hospital on account of severe headache. The headache yielded only to mercurial treatment. Six weeks ago he noticed that it was difficult for him to articulate, his memory became very poor and he suffered with headache, which gradually increased in severity. At the time of his admittance into the hospital his difficulty in articulation was well marked, his dementia unmistakable, and his memory for recent events was lost. Other prominent symptoms were apathy and insomnia. Now and then he experienced slight disturbances of consciousness. He would get out of bed and wander aimlessly around the room, not being able to find his way back to the bed again. Two weeks later the reaction of the right pupil to light was found to be slow and the left pupil was larger than the right with only a slight response to light. There was also a beginning optic neuritis in both eyes. The tendon reflexes in the lower extremities were active. Ideas of grandeur and hallucination were not observed. From letters which he wrote daily to his wife the well-marked dementia, incoherence in

thought, and corticomuscular disturbances in writing were demonstrated. This condition gradually grew worse, and only began to improve after a treatment with mercury and iodid had been instituted. Under this treatment the patient almost completely recovered in the course of a few weeks.

In the differential diagnosis between brain syphilis and paresis, if along with the signs of a diffuse brain affection there are symptoms of pressure, such as choked disc or well-defined focal symptoms, and not the signs of a general corticomuscular weakness of function; further, if there exists a combination of cerebral and spinal paralysis, which appears in irregular sequence, and shows a variation in intensity, then the clinical picture speaks in favor of a brain syphilis. In the psychic sphere the symptoms may be regarded as against the assumption of a general paresis if the changes of the psychic personality are not the most striking; but, if transient, disturbances of consciousness or depressive and maniacal excitation and paralytic conditions, along with the preservation of the remaining mental qualities, are observed. Erlenmeyer points out, in the discussion of the differential diagnosis, that in diffuse brain syphilis the delinquencies of the mental qualities are only partial.

**Combination of Paresis and Brain Syphilis.**—Both Westphal and Binswanger have recently referred to the clinical combination of dementia paralytica and brain lues.

**Arteriosclerotic Brain Disease in Former Syphilitics.**—Not infrequently differential diagnostic difficulties will present themselves in patients with arteriosclerosis who previously have had syphilis and in whom transient cerebral paralyses and mental deficiencies appear. In such cases the question presents itself whether we have to deal with a paresis, a specific endarteritis, or with an arteriosclerosis caused by the previous syphilis and its consequences. We are justified in assuming a general arteriosclerosis with a positive finding in the heart and peripheral arteries, and by the presence of albuminuria, when also the somatic symptoms, such as the speech disturbances, paresis of the facial or

extremities, are of a more permanent nature, and when, as a result of the apoplectiform originating paretic conditions, a greater or less degree of diminution in intelligence develops.

**Diffuse Arteriosclerotic Brain Disease in a Syphilitic.**—A manufacturer, forty-four years old, twenty-five years ago had syphilis. He also drank moderately. There was no neuropathic inheritance. His business required him to work hard, both physically and mentally. As a result of business worry and family care, he began two years ago to complain of headache, dizziness, and restless sleep. His family observed that he was easily irritated and inclined to sudden changes in humor. It became difficult for him to manage his business and sustained effort was no longer possible.

The examination revealed a considerable degree of central and peripheral arteriosclerosis, with slight albuminuria but no casts. The psychic sphere presented only irritability and weakness. A stay of three months in a sanatorium benefited him only temporarily. A few days after he had resumed his work his dizziness, headache, and insomnia returned, and he suddenly became confused and excited. A sort of dazed condition developed in which he had depressive delusional ideas, and also at times hallucinations. He was not given at this time antispecific treatment. This neurasthenic, irritable, and weak condition lasted four months, when another attack similar to the one described above appeared. As a result of this attack a slight dementia developed, which manifested itself chiefly in the failure of the patient to recognize his true condition and an overestimation of his capabilities.

Objectively there existed from the beginning a slowness in the response of the left pupil to light and an inequality in the size of the pupils.

Immediately after his first attack a suggestion of motor aphasia and a slight paresis of the right facial appeared. During a period of four years this condition remained practically unchanged. The patient was unable to pursue his business and required watching when he was away from



home. A repetition of the specific treatment on two different occasions did not produce any improvement. Three years later the patient was received into a private sanatorium where he died.

The autopsy showed a diffuse arteriosclerosis, particularly of the brain arteries. The brain macroscopically did not present the picture of paresis, microscopically there was no atrophy of the tangential fibres, the increase of the glia was not such as should correspond to a paresis which had existed a number of years, and there was diffuse arteriosclerotic disease of the small arteries. The spinal cord was microscopically intact.

Recently Weber, from his observations in five cases, has discussed in detail the points of differential diagnosis between the mental disturbances in arteriosclerosis and general paresis. His cases were in the fifties or somewhat earlier, at any rate in the age of predilection for the beginning of paresis with expansive ideas, exalted moods, and motor restlessness. At the same time there were some objective symptoms, especially relating to the pupils, present. General paresis was excluded in Weber's cases for the following reasons:

First. The ideas of grandeur were more in accordance with the normal conception of the personality, better adapted to the patients' calling and social station, and the patients attempted logically to prove these ideas; also they were less influenced by suggestion.

Second. In times of great excitement and carelessness of external behavior, the presence of mind, consciousness of personality, and knowledge of position remained intact. No dream-like states or confusion as in paresis appeared.

Third. The affection persisted for a long time with the intelligence preserved. The memory and perception may not be disturbed at all. Sometimes the patients have a full knowledge of their condition.

Fourth. Oftentimes ethical defects occupy the foreground of the clinical picture and consist in a disappearance of all altruistic impulses towards the immediate family. They are founded deeper than in paresis and extend, as may

be ascertained out of the personal history, back into the normal days. The condition consists more of a disappearance of restriction caused by the disease than of a character metamorphosis. The essence of the personality is better preserved than in paresis.

Fifth. The organic symptoms are in the beginning not so constant or so characteristic as they are in most cases of paresis with severe psychic disturbances. Articulatory speech disturbances are usually lacking. The pupil disturbances are not the simple loss of the light reaction alone, but this is combined with loss of accommodation as well. When the affection has existed a long time, there are also focal lesions, such as pareses, aphasias, and disturbances in writing.

Sixth. The duration of the disease from its acute beginning is much longer than in paresis, which is accompanied by such severe psychic disturbances.

Seventh. The course is extremely variable but does not come to a complete remission. There may be periods in which the patient's consciousness is fairly clear and the judgment good, without the irritable condition and ethical defects entirely disappearing.

Eighth. In all the cases the symptoms originated from an inherited tendency, which in addition to the above-mentioned anomalies of character expressed itself in a lessened resistance of the arterial system. Symptoms of this arterial weakness appeared in the previous history of the patient in the form of attacks of asthma, heart attacks, and angioneurotic disturbances.

Ninth. Along with these endogenous factors, exogenous agencies such as lues and alcoholism as accidental causes of the disease appear in several cases.

Tenth. The pathology is, according to the autopsy and the entire clinical picture, a diffuse disease of numerous small arterial branches which produce disturbances in the circulation and nutrition of the brain, and only in later stages lead to a permanent tissue change in the form of destruction of nerve elements, œdema of the tissue, and perivascular glia proliferation.

**Encephalomalacia in Syphilitics.**—The difficulties which the differential diagnosis presents in cases of encephalomalacia in syphilitics, who are not manifestly arteriosclerotic, is well illustrated in the following case:

A gentleman, thirty-eight years old, who had always been healthy and temperate, contracted syphilis when he was twenty-four years old, and took one course of treatment for this disease. In the summer of 1899 he complained for the first time of paræsthesias in the face, tongue, and arm and leg of the right side. The arm and leg also became weak at times. The examination of the patient did not reveal any particular degree of arteriosclerosis. The only somatic symptoms were an abnormal activity of all the deep reflexes, a slight limitation of the associated movements of the eyes externally, and insufficiency of the left rectus internus by convergence. Under mercurial treatment the attacks of paræsthesia and weakness of the arm and leg disappeared and the function of the eye-muscles became normal. The tendon reflexes continued abnormally active. The patient was discharged from the hospital at the end of six weeks. In six months he returned because of a speech disturbance and a change in disposition. A well-marked right-sided hemiparesis was now found to be present, and the intelligence was plainly weakened. His mental condition was that of a contented dement. At times he became excited and had hallucinations of hearing and sight. The hemiparesis varied in intensity. Four months later he had an apoplectic stroke. The right side became spastic with athetoid movements. The aphasia became complete. General symptoms which might be expected to accompany a brain-tumor were absent. The patient developed decubitus, became dull and stuporous, and died a few weeks later.

The autopsy did not reveal macroscopically any well-marked arteriosclerosis of the basal arteries. There were multiple small areas of softening of the cortex, large ganglia, and in various portions of the medullary substance, more extensive on the right side than on the left. The configuration and size of the cortex was not particularly changed; the pia was diffusely thickened and infiltrated.

The microscopic examination showed an extensive atheromatous condition of the small arteries and arterioles. The cells of the cortex with the Nissl stain were in part normal and in part in various stages of degeneration. The nerve-fibres with the Weigert-Pal stain (areas from the central convolutions were examined) were found to be partially atrophied, but not with the characteristic atrophy of paresis. Inflammatory changes or glia proliferations were not present to any extent.

In this patient it was difficult to tell, during life, whether the case was one of encephalomalacia, in a very young man, or a rather unusual type of paresis. The autopsy showed it to be one of encephalomalacia.

**Cerebral Neurasthenia.**—The question of differential diagnosis between cerebral neurasthenia and paresis also not infrequently presents itself. The four reactions, the Wassermann in the blood and spinal fluid, the globulin, and lymphocytosis will aid materially in making this distinction. Otherwise the so-called “neurasthenic vorstadium” of paresis does not differ materially from a true neurasthenia in a luetic. It might perhaps be said in general that in neurasthenia the hypochondriacal self-analysis and self-observation is more intense and persistent.

It is to be remembered too that somatic symptoms in paresis may not appear for a long time, and on the other hand a neurasthenic may present pupil anomalies as a result of his previous syphilis.

The differential distinction becomes especially difficult if, as Schüle, Köppen, and Jacobson have pointed out, through arteriosclerotic changes in the arteries supplying the anterior half of the oculomotor nucleus, degeneration of the nucleus is produced, and as a consequence of this various pupil irregularities appear. Such cases complicated with cerebral neurasthenia have been reported.

In general one must recognize the fact that the presence of organic symptoms in an old luetic presenting symptoms of cerebral neurasthenia does not always mean paresis, any more than the absence of these symptoms, for a long time, excludes the diagnosis. In such complicated cases the



findings obtained by an examination of the spinal fluid are to be considered as the surest means of differentiation; negative findings absolutely excluding general paresis and positive being strongly in its favor.

**Chronic Alcoholism.**—Chronic alcoholism often causes apathy, mental dulness, abnormal irritability, depression and maniacal moods, blunting of the moral sense, change in the personality, and a greater or less degree of severe dementia. Anomalies of the pupils, absence or increase in the deep reflexes, and psychomotor weaknesses in the innervation of the cranial nerves are also not unusual. The differential diagnosis formerly in the beginning frequently had to remain in doubt because of the similarity of the symptoms and the fact that alcoholics are also frequently luetic; at the present time the four reactions will clear up the doubt.

The following case illustrates the degree of recovery which can occur even in severe alcoholic psychic disturbances:

A young man, twenty-seven years old, was admitted to the hospital in a severe alcoholic delirium. After the termination of the delirium he exhibited the clinical picture of a typical amentia. His power of perception was totally lacking. His mood varied from a state of euphoria to one of deep depression. He had absolutely no realization of his condition. His mental state was imbecilic.

Objectively there were pupil differences and sluggishness in their response to light, deficient innervation of the facial and tongue musculature, and increased tendon reflexes. Three months later his mind was still very feeble, showing no improvement. After this, however, he began to improve, and in the course of six months his intelligence passed from that of a severe dementia to that of a slight mental deficiency. After the expiration of a year there still existed some indifference and apathy. His memory for the events previous to his illness was good, but for recent events was defective. Later he was able to resume his position in a factory and keep it.

Chronic alcoholism may closely resemble, both in the

physical and psychic spheres, paresis, and paresis may, on the other hand, present delirious states which are entirely similar to an alcoholic delirium.

**Brain-tumors.**—In brain-tumors mental disturbances can dominate the clinical picture. In this condition there is usually found a mental torpor which manifests itself in the form of limitation in thought and action. The patients act and speak as in a half-sleep. They respond to impulse only incompletely and for a short time. Sometimes periods of excitement may occur. These mental symptoms are the consequence of brain pressure, and with relief from the pressure they disappear. Only by a multiplicity of tumors and a well-marked hydrocephalus internus is the development of a permanent dementia possible. In such cases the condition is due to atrophy of the cortex by pressure.

**Syphilis and Migraine.**—It is very important to distinguish between typical or atypical genuine migraine attacks and attacks of a symptomatic migraine. Möbius says migraine is an inherited disease and begins in early youth. In those cases where its inherited nature cannot be demonstrated and the attacks do not appear until later in life, one should be very careful in making a diagnosis of migraine. Not only may, in disease of the kidneys, an approaching uræmia cause apparent migraine attacks, but also they may occur in brain-tumors, both as typical and atypical attacks, with visual and sensory aura which are accompanied by paræsthesias and aphasia. In a case reported by Abercrombie, headache which resembled in nature migraine was the only prodromal symptom for five months of a tubercle of the left hemisphere of the cerebellum.

Migraine is also a prodromal symptom in both tabes and dementia paralytica. Charcot was the first to call attention to this fact. Oppenheim observed migraine in tabetics very often. In thirty-two cases of tabes in women he observed migraine in ten.

Whether or not the syphilitic toxin can produce a hemi-cranial brain condition is another question. We may consider that the vasomotor theory of migraine has been aban-

done and that the changes in function of the arteries are to be regarded as secondary. When in syphilitics symptomatic migraine appears, it should not be attributed to arterial changes in the brain-cortex.

According to my own observation there would seem to be a causal relationship existing between a luetic intoxication and attacks of migraine.

According to a number of cases reported by Halban, it seems probable that migraine may sometimes be the only late symptom in hereditary lues.

The following case is of interest in this connection:

A woman, forty years old, the wife of a bank director, who had previously always been healthy, during the last year was affected with a general nervousness. During the last two months, in addition to this she had a persistent insomnia, attacks of dizziness, and severe headache, which was most painful over the parietal region and was worse at night. For a year and a half she had also had frequently-appearing attacks of migraine, which in her earlier life she had never known, nor was there any other case of migraine in her family. There were no aphasic or paretic disturbances, also no subjective symptoms from the eyes. The internal organs were normal, no arteriosclerosis was observable, and the urine was free from albumen and sugar. The mind was intact. The tendon reflexes in both upper and lower extremities were active without being pathologically increased. Sensory disturbances were also lacking. The pupils were abnormally small and the light reaction, both direct and consensual, was slow and limited in character.

From the history it was ascertained that her husband, ten years before, had contracted syphilis, for which he had been treated. Under antispecific therapy the general nervousness, headache, migraine attacks, and other subjective symptoms gradually disappeared. The pupil anomalies remained unchanged.

In spite of the permanent changes in the pupils, one is not justified in calling this case a beginning tabes, because of the active tendon-reflexes and the absence of all other symptoms of disease of the posterior columns.

The case is to be regarded as one of symptomatic migraine because of the absence of any hereditary tendency, and also because the migraine appeared rather late in life.

Attacks of ophthalmoplegia in severe attacks of idiopathic migraine have occasionally been observed. A case of acute complete ophthalmoplegia, which occurred in the course of a severe migraine attack of several days' duration, was reported by Trömmner.

In such cases, when other somatic symptoms are lacking, one must avoid assuming a relationship with lues because of the ophthalmoplegia. These cases may be better explained by regarding them simply as an expression of nuclear hemorrhage.



## X

### SYPHILIS OF THE SPINAL CORD

#### **Rareness of Lues When Confined to the Spinal Cord Alone.—**

The spinal cord is in general less often affected by syphilis than the brain. This may be explained by the fact that the most powerful factors in the etiology of diseases of the nervous system, such as heredity, trauma, infection, intoxication, as well as psychic and intellectual lesions in their fullest sense, involve the brain more frequently than the spinal cord.

Fournier reports more than five times as many cases of cerebrospinal syphilis as of the pure spinal type.

Gebhard in eight years in the large clinic at the Charité saw only nine cases of spinal lues.

Extension of specific disease to the spinal cord from the vertebral column occurs far less often than it does to the brain when the cranium is affected. Anatomical reasons may in a measure seem to explain this. In the cranium the periosteum and dura mater may be regarded as practically one covering, while in the spinal canal the vertebral periosteum and dura mater are separated by a thick layer of fatty tissue.

According to Erb's experience, specific disease of the spinal cord occurs only one-tenth as often as tabes.

In making a diagnosis, be exceedingly careful in the assumption of a pure syphilis of the spinal cord, and keep in mind always that the combination of brain and spinal lues is by far the most frequent.

Extensive specific changes in the brain may remain latent during life, as a case reported by Siemerling shows, while on the other hand latent syphilis of the spinal cord may exist with well-developed brain lues.

In a case reported by Weygandt clinically only brain symptoms were manifested, while pathologically extensive specific arterial changes were demonstrated in the lumbar cord.

In one of my cases the clinical picture presented was that of a severe transverse myelitis in the dorsolumbar cord. There were no symptoms indicating disease of the brain or medulla. At the autopsy, in addition to the spinal-cord affection, there was found to be a hard gummatous infiltration at the base of the pons and in the interpeduncular space.

**Spinal Syphilis May Appear Early.**—The old opinion that spinal syphilis appears only in the later stages of the disease has been proven incorrect. Gilbert and Lion, from the material of 44 cases of spinal lues, were able to show that quite a large proportion of this number manifested their first spinal symptoms within the first year after their infection. They were also able to collect 56 cases out of the literature where the spinal-cord affection developed within the first two years after the date of infection.

Fournier in 71 cases of spinal lues found that the disease appeared during the first year in 8 cases, the second year 18 cases, the third year 10 cases, the fourth year 10 cases; between the fifth and tenth years 17 cases, and between the tenth and twenty-fifth years 4 cases.

**Late Appearance of Spinal Lues.**—The spinal affection may also, as Fournier's experience has shown, appear very late. Williamson reports a case which occurred 27 years after the infection. From my material one case developed in the twenty-fourth year. In the 24 cases which have come under my observation, one-half of them occurred within a period of five years after the infection. This agrees fairly well with Oppenheim's statement that one-half of the cases of spinal lues occur within a period of six years from the date of the infection.

**The Previous Syphilis May Have Been Slight or Severe.**—In some of my cases the original specific symptoms were insignificant in character. This was not the rule, however. Gilbert and Lion have stated that, in contradistinction to brain lues, spinal syphilis was more apt to occur in the severe types of the disease.

**Men More Frequently Affected Than Women.**—Men are more often affected with spinal syphilis than women. In

my 24 cases, eight were in women, 16 in men. From these eight cases only two of them were from the higher classes. One must take into consideration, however, that syphilis in general is of more frequent occurrence in men than in women and also that the life of men predisposes them more to organic nervous disease than that of women.

**Influence of Therapy.**—Brasch states that, as with the brain, so also with the spinal cord, the more thorough and prompt the antispecific therapy, the less liable it is to become diseased.

**Influence of Age.**—What has been said in the chapter on brain syphilis in regard to the effect of syphilis acquired



FIG. 33.—The blood supply of the spinal cord in a transverse section.

late in life, and also the neuropathic disposition, applies equally as well here.

The clinical case of Fournier illustrates the causal effect of physical exhaustion of the spinal functions in the sense of Edinger. The case was that of a luetic, who after a long bicycle ride developed a fatal specific myelitis.

**The Peculiarities of Spinal Lues Are Due to the Anatomical Peculiarities of the Cord.**—The form of the spinal cord causes some peculiarities in the pathology of luetic spinal disease. Owing to the smallness in the diameter of the cord, symptoms of a transverse lesion easily occur. The tracts which conduct the important sensory and motor, as well as the reflex, functions are situated closely together so that slight lesions produce severe symptoms.

While in the brain the blood-supply is conducted in straight paths from the heart; before entering the spinal cord the blood channels bend at right angles in order to enter the anterior median fissure. On the other hand, as in the brain, so also in the spinal cord the small arteries are associated internally with the pia and penetrate with it into the interior of the cord. This explains the important rôle played by the arteries in spinal lues.

The membranes of the cord relatively are more frequently affected than the membranes of the brain.

**The Pathology.**—The pathology of syphilis of the spinal cord may be divided into that of the coverings and of the cord itself.

**Syphilis of the Vertebrae.**—The bony envelope is very rarely affected. How rarely one may realize when an experienced pathologist like Eugen Fraenkel, who has had the opportunity of observing the vast material in the Hamburger City Hospital during the last thirty years, states that he has never seen a case.

Leyden says that the diagnosis of specific vertebral exostosis has been too lightly made. The following case illustrates how careful one should be in making the diagnosis from the clinical symptoms. A man, forty years of age, had contracted a syphilitic affection on his chin. A year later he was taken sick with some pains in his neck and soon developed a spastic paraplegia of all four extremities, with severe disturbance of sensation and slight involvement of the sphincters, all the cerebral nerves remaining intact. The sixth, seventh, and eighth cervical vertebrae were sensitive to pressure; pain on jarring or jolting also existed and the limitation of motion common in a spondylitis was present.

Under a mixed treatment of almost two years' duration the symptoms slowly disappeared. Three years later there appeared a chronic fungous inflammation of the right ankle-joint which with surgical care and renewed antispecific therapy healed. Again after three years there developed a burrowing abscess from a diseased rib. There was no other evidence of a tuberculosis. Two years later the patient



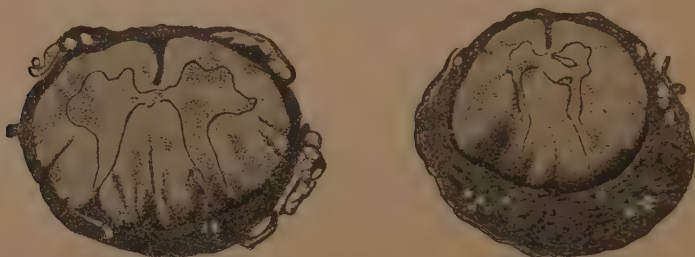
died with amyloid degeneration of the abdominal glands, eight years after his specific infection. The autopsy showed a thick indurated proliferation in the leptomembranes and the dura in the cervical region, which microscopically revealed nothing of the appearance of either syphilis or tuberculosis. The bodies of the sixth to the eighth cervical vertebræ were partially necrosed. The caries had healed. In the apex of the right lung there was a small calcified tubercular area. In this case there had in all probability been a specific meningitis and a tubercular caries.

Staub reports a case of a very slow-developing deformity of the vertebral column, accompanied by a papulosquamous process of the skin on the face and a swelling of the glands of the neck. The success of the antispecific therapy convinced Staub of the correctness of his diagnosis because not only the exanthema, but also the enlarged glands and the symptoms depending on the disease of the spinal vertebræ, such as neuralgic pains and symptoms of spastic paraplegia in the lower extremities, disappeared. At any rate, it is well to remember that syphilis of the spinal vertebræ is rarely met with and in the pathology of spinal syphilis occupies a very unimportant place.

**Syphilis of the Membranes.**—The membranes of the spinal cord are usually affected together. The pia and arachnoid become agglutinated with spongy, newly-formed connective tissue to the inner surface of the dura on the one hand and with the substance of the spinal cord on the other. Isolated disease of both the pia and dura may occur, however. The meningitis may be diffuse or it may manifest itself in small or large circumscribed areas. These areas are usually multiple. The diffuse form of inflammation occurs more frequently in the dura. In the pia the inflammation is oftener localized. The caseation, necrobiosis, and connective-tissue metamorphosis of the pia gummata is a common occurrence; all the transitional types are found, from the fresh acute purely inflammatory infiltrations of the membranes to the genuine connective-tissue indurations which no longer present any evidences of inflammation.

The acute form of meningitis in syphilis is manifested

by diffuse small-celled infiltration of the meninges, which is especially localized around the blood-vessels, as well as by proliferations of new connective tissue. The inflammatory processes may surround the cord in a ring-like manner or they may be located on the anterior or posterior surfaces.



FIGS. 39 and 40.—The meningitic proliferation is more strongly developed on the posterior surface of the cord than on the anterior. Cone-shaped proliferations penetrate from the meninges into the cord itself. (Chronic specific spinal meningitis.) (Böttiger.)

Specific meningitis is by far the most frequently located on the posterior surface of the cord. The disease is also more extensive and more marked in this location.

Oppenheim, Rumpf, and Jürgens are of the opinion that the cervical cord is most often affected, while Gold-



FIGS. 41-47.—Inflammatory thickening of the meninges. Extension of the specific inflammatory infiltrate into the cord, especially in the posterior and lateral columns.

flam and Richter, according to their experience, consider specific meningitis shows a predilection for the dorsal and dorsolumbar cord. A review of the literature does not permit the recognition of any essential difference; nevertheless the cases in which the chief involvement is in the lumbar region are rare. Gummatous disease occurs either in a

diffuse form or as circumscribed small or large tumors. In a case reported by Rosenthal, the tumor was 3 cm. long and compressed the cord from the second to the third cervical roots. On the other hand there may be numerous gummatous tumors of the dura varying in size from a grain of rice to a pea. The same regressive changes may occur in the spinal meningeal gummata as have been described as occurring in the gummata of the brain.

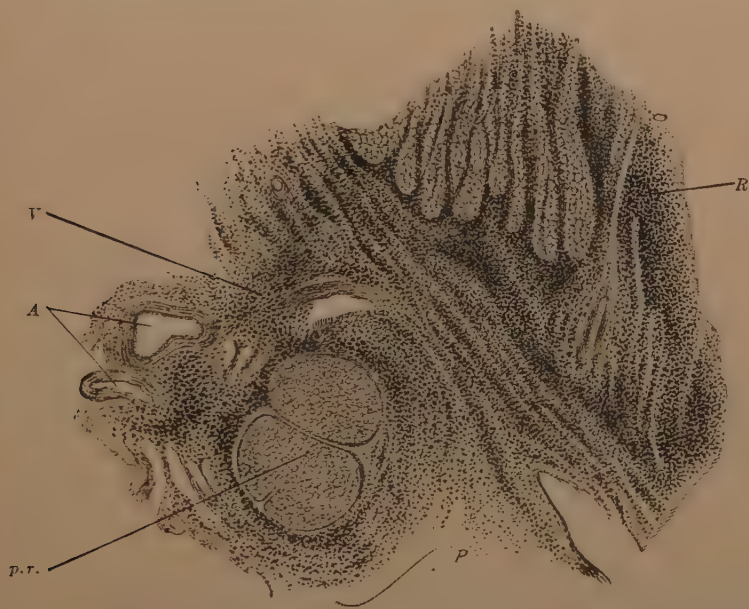


FIG. 43.—Part of a transverse section from the dorsal side of the cord, with the adjacent pia and the root bundles lying in it. (Siemerling.) A, artery; V, veins; R, spinal cord; P, pia; pr, posterior roots.

The chronic inflammatory process in the cases in which all the membranes are affected histologically has its inception from the arachnoid.

The leptomeninges are particularly predisposed to disease because of their numerous blood- and lymph-vessels.

The leptomeningitis extends along the septum to the spinal cord and fresh and old small-celled infiltrations, with or without gummata, push cone-shaped into the substance of the cord.

There is no doubt, although of rare occurrence, but that a primary independent pachymeningitis, originating on the

one hand from the spinal vertebræ and on the other from the pia and arachnoid, sometimes occurs.

**Disease of the Blood-vessels.**—A not inconsiderable rôle is played by the disease of the blood-vessels. Naturally the same conditions are presented which have been described in the brain. We know now that the veins are rarely normal and that along with the stenosing and obliterating endo-, meso-, and periarteritis an endo- and periphlebitis is almost always a regular accompaniment and often produces veno-sclerosis. In a case of acute myelitis Lamy found patho-



FIG. 49.—Thrombosis of diseased vessels, with secondary hemorrhages. (Williamson.)

logical changes only in the veins. The same observer also reports a case of meningomyelitis in which the veins alone were affected. Such cases cause one to think, as Rieder has shown as probably true in the neighborhood of the primary lesion, that also in the nervous system the veins are the first to become involved.

**The Cord Itself is Not Primarily Affected.**—The substance of the spinal cord does not become primarily affected in syphilis. The parenchyma of the cord becomes involved secondarily and in various ways. It may be affected by a meningitic process in the form of a circular sclerosis on the surface of the cord or it may become diseased trans-



versely along the entering proliferating pia septum. The nerve-fibres are then compressed by the chronic inflammatory tissue; also by compression, stasis in the blood- and lymph-channels is gradually produced with its consequences. The atrophy of the nerve-tissue is followed by an increase in the neurologia.

**Chronic Myelitis.**—The meningomyelitis is the most frequent form of manifestation of lues in the spinal cord. This fact is especially important for an understanding of the clinical picture of spinal specific disease. Above and below the degenerated areas sclerotic changes occur—secondary



FIG. 50.—Intraspinal gummata with surrounding meningitis. (Williamson.)

degeneration. When the products of inflammation constrict the posterior roots and thus cause degeneration, then there results ascending intramedullary degeneration.

**Gummata in the Substance of the Cord.**—Gummata multiple or solitary may also occur in the spinal cord, either in the white or gray substance; in the neighborhood of the gummata, softening of the substance of the cord may occur, due either to disease of the blood-vessels or to the deleterious effect of the specific toxin on the nerve-tissue.

**Disease of the Gray Substance.**—The anterior gray substance is not infrequently affected, in the form of changes in the ganglion-cells, which are swollen, vacuolized, without nuclei, and with their processes destroyed. In other cases there are hyperæmia and hemorrhages.

**Transverse Myelitis.**—All parts of the cord may become diseased transversely in the form of small foci which were formerly classified as myelitis but at the present time are more correctly regarded as vascular softenings. If several of the foci are adjoining, then there is presented, as in the case with a large focus, the picture of myelitis transversa. This process may have an acute beginning, then one finds microscopically the picture of simple necrosis.

**The White Substance More Often Affected Than the Gray.**—The white substance is much more frequently affected than the gray, and the posterior and lateral columns are oftener involved than the other parts of the white matter.

The question as to whether myelitis or meningitis is the primary factor in the pathology is an important one. We know that in severe disease of the membranes, especially of the pia, the white substance shows a peripheral sclerosis, which at the points where the pia is adherent is the most marked. Signs of primary disease of the cord itself are manifested by simple foci and extensive softenings and cavity formations in the white substance.

**Root Neuritis.**—The roots may become diseased in several ways (Buttersack, Kahler). They may be compressed by the specifically inflamed pia, the inflammation may extend from the pia into the roots themselves and thus injure the individual nerve-fibres secondarily. Proliferations may also originate from the specifically diseased vessels, the disease of the roots may consist entirely in an affection of the vessels, which can take on either the character of Heubner's arteritis or an inflammatory character, and finally, in addition to the forms of involvement just mentioned, gummata may become localized in the roots.

It is worthy of mention that up to the present time where the roots have been affected, in severe disease, they have never been entirely destroyed, but here and there individual fibres have been found preserved.

Very often a disproportion exists between the disease of the spinal roots and the cord itself, but no case has ever been reported of isolated disease of either the roots or cord.

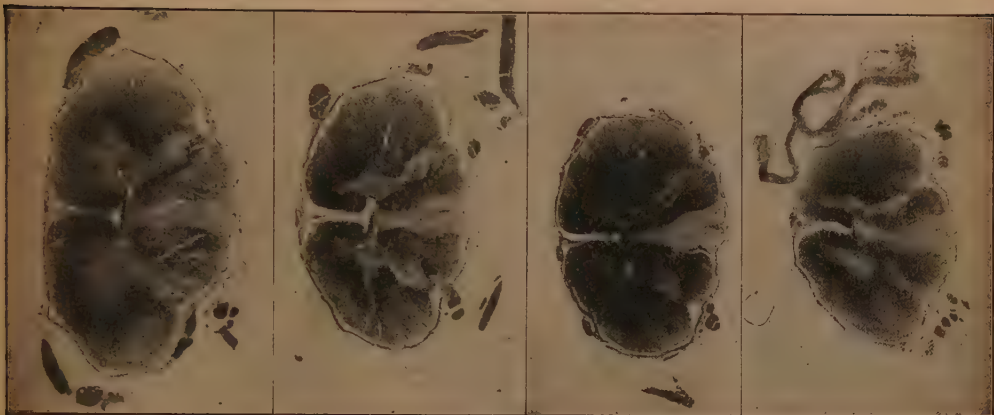


FIG. 51.

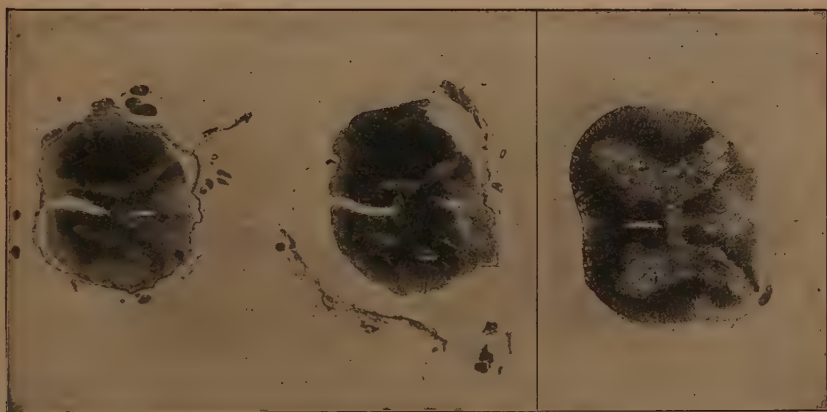


FIG. 52.

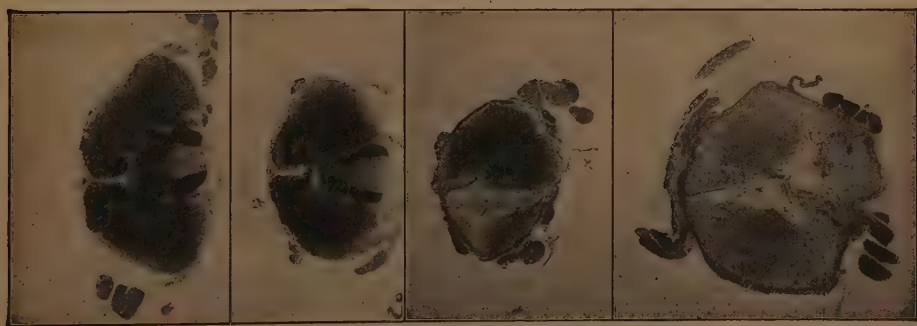


FIG. 53.

**System Disease.**—The discussion concerning the so-called system diseases of the cord, the systemic degenerations of the posterior and lateral columns and the anterior horns, has received considerable attention in the literature of syphilis of the spinal cord. Combined disease of the posterior and lateral columns in a large number of cases is regarded as the result of syphilis. In these cases the process is undoubtedly due to post- or metasyphilitic disease and not to the causative factor of lues. We agree with Strümpell, who has stated that, as a consequence of the specific process, a chemical poison is created which exercises a selective action upon the system tracts of similar function. A genuine specific affection causes no system involvement, but portions of systems are often affected in irregular form. In the majority of instances the system affection is only simulated and in reality there exists a peripheral sclerosis as a result of insufficient nutrition because of disease in the meningeal vessels. In these cases the central regions of the white and gray substance remain intact. The peripheral sclerosis can produce ascending and descending degeneration and thus resemble system disease. In other cases the development of pseudosystem disease depends upon the topographical relations of the affection in the course of a meningomyelitis (*pseudotabes syphilitica*), as observations of Oppenheim, Eisenlohr, and Ewald have shown.

A large number of observations (Dinkler, Minor, Kuh, Fr. Pick, Nonne) have demonstrated that, with the classical parasyphilitic disease, tabes, a true specific meningitis may occur.

Erb, in an exceedingly interesting and stimulating study called "Observations Concerning the Pathology of Syphilis of the Central Nervous System," expresses the opinion that the apparently indifferent, primary, parenchymatous degenerations (atrophy, sclerosis, system disease) are just as much the result of syphilis as the so-called gummatous specific lesions and the diseases of the blood-vessels. These atrophies and degenerations should, with the same right as



specific gummatous lesions, be regarded as syphilogenetic in origin if the same measure is applied to both. It is in this sense that Erb considers the system disease, tabes, and the combined system disease, as it has been found in individual cases, developing from a specific spinal paralysis, as syphilitic.

**The Pathology of Spinal Syphilis in Itself Not Characteristic.**—In conclusion the question naturally arises as to whether all of the pathological processes or a part of them are characteristic of syphilis. With the exception of the gummatous diseases, this question must be answered in the negative, and it must further be admitted that all of the individual pathological findings in syphilis of the spinal cord have analogies in non-syphilitic processes.

The residual of an acute meningitis in syphilis cannot be differentiated from other forms of meningitis of different origin. All types of meningitis may terminate in fibrous induration. Even in a gummatous growth the microscopic examination proves only that the tumor can be of specific origin. The combination of the different findings is, however, fairly characteristic of nerve syphilis. If one finds gummatous nodules in the inflamed meninges and spinal cord, in addition to endarteritis and endophlebitis, also softenings and sclerosis, either circumscribed or diffuse, one may assume with considerable assurance a specific etiology.

Recent observations, however, concerning the manifestations of tuberculosis of the cord have taken away some of the certainty from this last assumption.

Schamschin, from extensive observations in tuberculosis of the central nervous system, has described pathological findings which in multiplicity, in the meninges, parenchyma of the cord and in the blood-vessels, equalled those of syphilis.

Confirmation of the pathological diagnosis, if sought for in the other internal organs, will usually be discovered. In spite of the absence of a single characteristic finding, however, Wieting is right when he says that, in the great

majority of cases of meningomyelitis, syphilis may be assumed as the cause. As has been said with reference to brain syphilis, so here it is also true, that a careful consideration of the various factors, the relationship and condition of the other internal organs, and last but not least the clinical course, will in the majority of instances enable one to make a positive diagnosis.

**Symptomatology, Multiplicity of Symptoms.**—This review of the pathology which syphilis of the cord produces will aid us to a certain extent in a better understanding of the great variety of symptoms which spinal lues may present. Accordingly as the pathological changes are most marked in the meninges or in the cord itself, we have meningeal or cord symptoms predominating.

**The Meningeal Symptom-complex.**—The general meningeal symptoms are essentially the same as in other forms of meningitis, pains in the neck, between the shoulders or in the back, paræsthesias, painful sensations and severe attacks of pain which radiate to the upper or lower extremities and the upper and lower portions of the body; objectively, hyperæsthesia and diffuse sensitiveness to pressure in the regions in which the pains exist. Along with these sensory irritative symptoms there appear also symptoms of motor irritation in the form of tension in the musculature which may increase to contractions. The tendon- and skin-reflexes are increased. In almost all the cases one finds a rigidity of the back combined with a localized or, what is more frequent, a diffuse tenderness to percussion of the vertebral column, as well as a painfulness upon movement. The French observers following Charcot have emphasized the point that the pain at night is more severe than during the day. In the cases which I have observed, the pain has not been particularly worse at night and I have been unable to find anything in the German or English literature to substantiate this contention. Severe paralysis with atrophy of the muscles and changes in the electrical response of the muscles affected are evidence that the spinal roots secondarily, because of the meningeal inflammation, have become involved. Naturally one encounters here temporary transi-

tional symptoms, since a severe hyperæmia with extravasation can exercise a slight compression upon the peripheral parts of the cord and spinal roots. Regional hyperæsthesias and anæsthesias, vasomotor paralyses and symptoms of irritation with some dysuria may be enrolled under the meningitic symptoms. Slight paretic conditions of the extremities or a part of an extremity also belong to the typical picture of a meningitis. Not infrequently the paresis is only a pseudo one, since the patient through fear of attacks of pain will not move the extremities.

**Meningeal Irritation.**—Lang has especially called attention to the meningeal irritation in the beginning of the secondary period of syphilis; the backache, paræsthesias in the upper and lower extremities, weakness and a feeling of tiredness in the arms and limbs, slight irritation of the bladder, active skin- and tendon-reflexes he regards, as do also Jarisch and Finger, as the manifestation of an inflammatory congestion of the blood-vessels of the spinal meninges.

Fournier has also frequently observed in the beginning of the secondary period a regional symmetrical analgesia, or a disturbance in the temperature sense and sense of touch, which he ascribes to the same cause. Schnabel has often seen, as an objective proof of this hyperæmic condition in the inception of the eruptive stage, a hyperæmia in the background of the eye.

Friedman has described as objective symptoms the regional analgesia and hyperæsthesia, anomalies of the tendon-reflexes, localized pareses, and amyotrophies. He calls these symptoms "complications of spinal irritation in luetics." A pathological finding has not been reported, but without doubt a search for such lesions in the autopsies of syphilitics who have shown irritative meningeal symptoms of a sensory nature would often lead to a positive finding and to a more correct understanding of the existing condition.

We know at present that a meningeal irritation occurs in about 70 per cent. of the cases in persons infected with syphilis. Very soon after the infection we also know that

in 30-40 per cent. of such cases a lymphocytosis is present in the spinal fluid in otherwise nervously healthy persons. Ravaut has shown that changes in the spinal fluid may exist a long time before any clinical manifestations appear, also that these spinal fluid changes may disappear without the development of any clinical symptoms. Nicols and Hough have succeeded in infecting rabbits with the spinal fluid taken from syphilitics in the secondary period, showing that this fluid contains virulent spirochætes.

Steiner and Mulzer obtained three positive inoculations from the spinal fluid taken from twenty cases of secondary syphilis by the injection of it into the testicles of rabbits. This was a relatively high percentage, since most of the rabbits died from an epidemic before the period of incubation was over.

The following is one of the cases from which a successful inoculation was made:

A girl eighteen years old with papules and extensive condylomata. The inoculation occurred on January 20, 1913, 1 c.c. of spinal fluid being injected into the testicles of a rabbit. In the centrifuged fluid only from two to three lymphocytes appeared in any one field. No pathological changes in the fluid were demonstrable. Globulin and Wassermann were negative. Wassermann in blood positive. On April 19, 1913, a circumscribed orchitis appeared in the rabbit, in specimens taken from which typical spirochætes could be demonstrated. The experiments of Steiner and Mulzer demonstrate that spirochætes may be present in the spinal fluid of cases of secondary lues without any pathological change manifesting itself in the fluid.

During the last two years a large number of observers have occupied themselves with the question as to whether an abnormal spinal fluid proves disease of the central nervous system. Max Fraenkel, in my clinic at Eppendorf, Bergel and Klausner, Dreyfus, Wechselmann and Mattauscheck should be especially mentioned. They found that in the secondary stage, with no objective evidence of nervous involvement, the spinal fluid may occasionally show a Phase I reaction and also a Wassermann with a large amount of fluid.



A survey of recent observations shows that on the one hand the Wassermann in the spinal fluid does not come through a filtering of the antibodies out of the blood, but is formed there. The reports increase where the Wassermann was negative in the blood but positive in the spinal fluid. On the other hand, Hauptmann, and others, have proved that a filtration of antibodies from the blood into the spinal fluid may occur in cases of infectious disease in syphilitics which after the recovery from the infectious disease again disappears. In the light of our present knowledge, one may assume that the Wassermann reaction in the spinal fluid indicates an active syphilitic process in the central nervous system.

An important case in this connection was reported by Versé. In this case, one of phlebitis cerebrospinalis syphilitica, spirochaetes were found in large numbers in the spinal ganglia and the nerve roots without any clinical symptoms whatever of a root neuritis. The spinal fluid had reacted positively. This case demonstrates that the nervous system may be permeated with spirochaetes without the appearance of nervous symptoms. One must agree with Hauptmann when he says that the appearance of the three reactions in the spinal fluid in early syphilis proves the existence of a meningitis which one may call "early specific meningitis." A review of the literature indicates that the lymphocytosis appears first and that it is the most sensitive of the reactions to a specific infection of the meninges. The albumen and globulin increase comes next and the Wassermann last. Dreyfus and Altmann from a large clinical material have determined that in about 70 per cent. of the cases of "early specific meningitis" (Hauptmann) a spontaneous recovery occurs, brought about by the natural resistive forces of the body.

**Spinal Meningitis.**—These same symptoms are also encountered in the prodromal stages of myelitis or meningo-myelitis. Here they are more severe. A still better proof of the meningeal irritation after specific infection is found in the lymphocytosis and increase of the globulin constituents of the spinal fluid.

Our knowledge of the pathology of an actual meningitis, the spinal cord remaining unaffected, is naturally limited, for it is in such cases that timely treatment causes a disappearance of the process and the recovery of the patient. The following case must be regarded as one of specific spinal meningitis:

A man, twenty-three years old, developed a chancre on his penis which healed under local treatment. Two months later an eruption appeared. Two weeks after the disappearance of this eruption he complained of lancinating pains in both limbs, especially in the right and in the lower part of the spine. Now and then he had paræsthesias in the right leg and also a slight dysuria. The pains were about the same during the day as they were at night, varying in intensity but usually severe. Stiffness of the back was complained of. The right lower limb was somewhat weaker than the left. Both the limbs were hypersensitive to percussion, the right more so than the left. The same condition existed for pin-pricks; otherwise sensation was normal. Both the tendon- and skin-reflexes were active. Passive motion produced no tenseness in the muscles. The entire spinal column was held somewhat rigid and in the lumbar region was sensitive to both pressure and percussion. Kernig's symptom was present. The cranial nerves were not involved and oculopupillary symptoms were absent. Mercurial inunctions were administered, and after the fourth inunction the patient said his pains were better and after the tenth they had entirely disappeared. His other symptoms likewise disappeared.

In the following case, in addition to the meningitis, the cord was also slightly involved:

A young man, twenty-three years old, had two years before contracted syphilis. Six weeks before I saw him he was seized with girdle-pains under the costal arch, paræsthesias in the feet and legs, and a paresis of the bladder. These symptoms were followed by a weakness in the lower extremities which manifested itself in a difficulty in standing and walking; a motor weakness was found in the elevators of the hips, extensors of the thighs, and the adduc-

tors. The patellar and Achilles reflexes were active and Babinski's and Oppenheim's phenomena existed on both sides. All these symptoms responded quickly to antispecific treatment.

These cases illustrate well the clinical picture of spinal meningitis. They also demonstrate its quick response to antispecific therapy and its excellent prognosis so long as irreparable secondary changes in the cord have not occurred. They show further that specific spinal meningitis very often appears quite early in the course of a specific infection. Both Oppenheim and Siemerling have laid particular stress on the changing behavior of the patellar reflexes. These reflexes may be active one day, weak the next, and several days later wanting entirely, only at a still later time to reappear. The variation in swelling of the specific infiltrated tissue which compresses the fibres which are responsible for the patellar reflexes is the explanation given for this.

## XI

### MENINGOMYELITIS

#### **Meningomyelitis the Most Frequent Form of Spinal Syphilis.**

—Meningomyelitis is the most frequent form of spinal-cord syphilis. We have already learned in what way the spinal meninges become affected, and have also seen how the cord itself may become involved by either acute, subacute, or chronic forms of meningitis. We have seen how the softening, or myelitis as it was formerly called, may involve the entire cord transversely in a single lesion, and how the lesions may also be very numerous and disseminated.

**Arterial Distribution.**—Through the labors of Adamkiewicz and Kadyi we know that the anterior gray matter as well as the adjoining white substance is richly supplied by arteries which radiate from the periphery into the interior of the cord. The posterior gray matter and posterior columns are also well supplied with their own arterial system. These anatomical conditions, together with the fact that the various blood-vessels, arteries, veins, and capillaries are so exceedingly prone to disease, will explain in advance the frequency of the vascular forms of specific spinal-cord affections.

**The Clinical Symptoms Depend Upon the Location of the Arterial Disease.**—It will therefore be easy to understand, if in a gradually developing arterial disease no region is spared, why the clinical picture presented is one of chronic transverse myelitis, when the vessels in the anterior and lateral columns are most affected, why the picture of an incomplete myelitis presents itself, or when the arteries supplying the posterior columns are the most affected, why the symptoms of disease of the posterior columns appear. It will further become plain that through a combination of the processes the symptoms exhibited may be manifold in character, depending upon whether the disease of the vessels extends rapidly and acutely in the different cord areas, or whether it encroaches slowly and chronically.



The fact that both the anterior and posterior roots have their own arterial branches makes it possible for the development of root symptoms through localized arterial disease.

The multiple character of meningomyelitis cannot be emphasized too strongly. The picture of a compression myelitis may appear if the meningeal exudate is extensive enough and slowly compresses the cord at a given spot, the epidural and epipial proliferations also disturb through pressure the circulation in the spinal lymph system and by compression of the larger vessels create a general transverse ischæmia and by a shutting off of the circulation of lymph a more or less extensive œdema longitudinally of the cord.



FIG. 54.—The dotted area is supplied by the anterior spinal artery, the lighter area surrounding it by branches from it on the one hand and also on the other by branches from the vasa corona; the darker peripheral area is supplied by the peripheral arteries of the cord. (Williamson.)

If finally large foci of softening or sclerotic areas develop, then secondary degeneration of the ascending and descending type appears. Tumor-like conical growths which extend from the meninges into the substance of the cord compressing and destroying the nerve-tissue also merit consideration. This newly-formed gummatous tissue can penetrate into the cord naturally from different points and involve different areas, thus producing a multitude of different symptoms. Fig. 55 from Homén's work illustrates this.

The meningitis is usually the most severe in the dorsal part since here the spinal cord has the least resistance. Consequently myelitis in the majority of cases manifests

itself as a dorsal myelitis. The meningitic symptoms are the same as have been described in the previous chapter. They may be very severe and cause considerable suffering for a long time. They exist for days, weeks and months as premonitory symptoms alone, indicating the gradual development of the disease. In other cases they may be slight and for this reason not paid much attention to by the patient

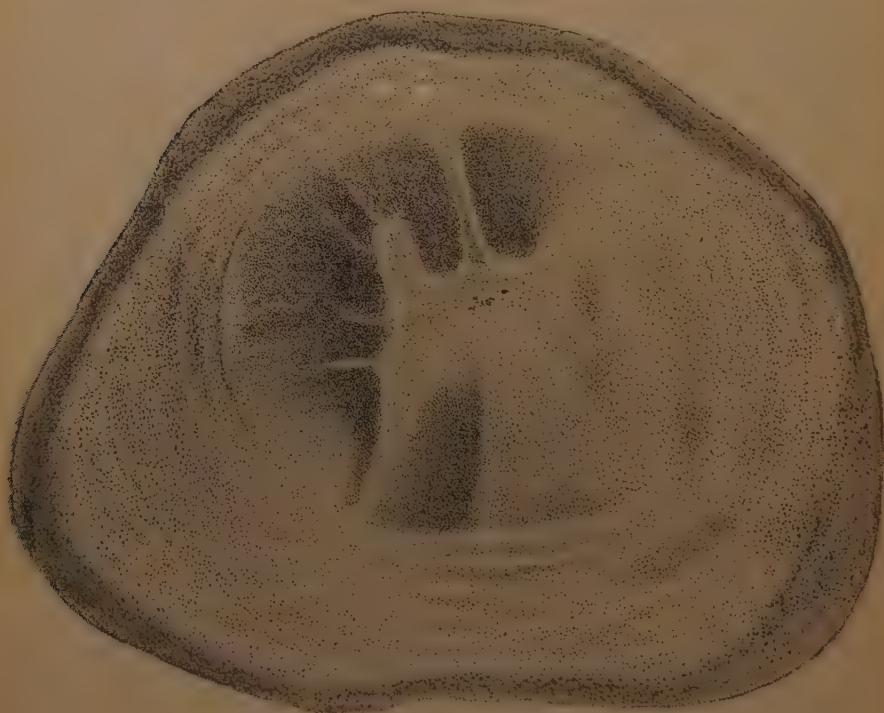


FIG. 55.—Syphilitic spinal meningitis. (Homén.) Dorsal myelitis.

who complains of some stiffness and tiredness in the back, drawing in the limbs, and rheumatism in the arms. Then the disease progresses further with paræsthesias, and finally a subjective feeling of weakness in the lower extremities ushers in the myelitis. The motor weakness may exist as a paresis or it may increase to a complete paraplegia which is usually spastic in character.

Sensation may be disturbed in individual qualities or all of its qualities may become involved. According to our

present experience the temperature sense occupies a peculiar position. The other qualities of sensation may be absolutely intact and temperature sense be the only one affected, and *vice versa*, it may be the only quality of sensation remaining intact when all the others are affected.

The dissociation of sensation may still be further increased when the feeling for either warm or cold is lost separately. The sense of pain may also be lost alone or both the temperature sense and the sense of pain together may be affected, the other qualities remaining preserved. In general, disturbance of sensation is not usually so complete as disturbance in motion.

The tendon-reflexes are usually increased and Babinski's and Oppenheim's phenomena, either singly or together, present. The skin-reflexes are either increased or diminished.

A weakness of the bladder function belongs to the early symptoms, may indeed be the first symptom which follows the prodromal symptoms and causes the patient to seek medical advice. It is apt to be a persistent symptom and in those cases where prompt treatment brings about a disappearance of the motor and sensory symptoms, not infrequently the bladder weakness remains for a long time as the only remaining trace of the affection.

**Lumbar Myelitis.**—Myelitis of the lumbar cord does not occur so often. Corresponding to our knowledge of localization when a transverse lesion develops in the lumbar region a flaccid paralysis occurs and both the tendon- and skin-reflexes are lost. Concerning the behavior of sensation, what has just been said in regard to it is also true here. The bladder disturbance may be in the form of a detrusor or sphincter weakness, or a combination of both. The picture of ischuria paradoxa may also occur. This form of myelitis is especially prone to decubitus and severe trophic disturbances. The tendon and periosteal reflexes of the upper extremity without any disturbance of motion or sensation may be increased, indicating that the meninges are hyperæmic.

**Cervical Myelitis.**—If the cervical cord is affected then all four extremities undergo motor and sensory disturb-

ances. The sensation is affected particularly here in the form of individual qualities. If the eighth cervical and first dorsal roots are involved then symptoms of an affection of the sympathetic appear. The pupil of the side involved is smaller, the bulb is sunken, the side of the face shows anomalies in the sweat secretion, and is cooler than normal. These symptoms may appear singly or in combination.

Two facts worthy of mention in the symptomatology should be spoken of here:

1. In many cases brain symptoms precede the true spinal-cord symptoms. The patients suffer from severe headaches or attacks of dizziness or transient aphasic disturbances or unilateral paræsthesias or paresis in the extremities.

2. In all forms of meningomyelitis the symptoms may vary in extensiveness and intensity. This variation in the symptoms is particularly emphasized by such observers as Westphal, Oppenheim, and Siemerling as a characteristic of the syphilitic form of meningitis. It does not occur in all cases, however, and such an experienced observer as Goldflam has never been able to find the change in the patellar reflexes which the other authorities mention so prominently.

The following case is an example of the most frequent clinical form of spinal lues, chronic dorsal and cervico-dorsal myelitis:

The case is one of a woman, thirty-eight years old, whose husband four years before his marriage had been treated for chancre and secondary symptoms. Six weeks before coming under my observation a paresis of the lower extremities with a weakness of the bladder and girdle-pains in the region of the nipples had developed. Objectively at the time of the examination a spastic paresis of the lower extremities with slight diminution of sensation for all qualities as far as the hips could be demonstrated. The spinal column was intact. The motor and sensory symptoms progressed to such an extent that three weeks later the picture of a transverse dorsal myelitis was well developed. Under



antispecific treatment all the symptoms gradually disappeared so that in six months' time the patient was able to walk, although tiring easily and spastic in gait.

The following case is interesting for two reasons: First, because it shows a spastic paraparesis of the lower extremities may develop in other ways than by the slow progressive form. Second, that energetic antispecific therapy at first did not influence the process and that it was only after a long pause in the therapy that a renewal of the treatment succeeded in bringing about almost a complete recovery.

**Specific Cervical Pachymeningitis, Chronic Dorsal Myelitis.—**

An unmarried man, thirty years old, had three years before his present illness a chancre. He received at that time a course of inunctions of ten weeks' duration, and had taken potassium iodid for a long time. Nine months ago he was seized suddenly with a paralysis of the right arm with paræsthesias. Under a three months' administration of potassium iodid and mercury this paralysis almost entirely disappeared. Shortly after this the patient complained of lumbago-like pains in the back which lasted eight days. Three months ago he was taken with a suddenly-developing paralysis of the left leg, which in the course of two weeks extended to the right leg.

The examination revealed a slight paresis of the right arm, a typical spastic paresis of the lower extremities, with slight hypæsthesia for all qualities up to the nipples. Energetic mixed treatment produced at first no improvement. Except for the varying intensity of the spastic symptoms the condition remained practically stationary for nine months. Renewed administration of the mixed treatment brought about a gradual improvement so that at the end of twelve months the patient was able to walk almost normally without a cane. Four weeks before his discharge from the hospital there remained a slight spastic paresis of the lower extremities with a slight hypæsthesia for all qualities limited to the legs. The left pupil was larger than the right. The light reaction of both were poor. Ophthalmoscopically, there was a grayish appearance of the temporal half of the papillæ.

In the following case the cardinal symptoms were a very considerable degree of spastic paraparesis of the lower extremities and a marked interference with the bladder function. The case also shows the incongruence existing in the relationship between motion and sensation, and how marked the disturbance of one quality of sensation, in this instance the muscle sense, may be. It shows further the degree of variation which may occur in the motor function and how futile sometimes a thorough and prolonged anti-specific treatment is in arresting the disease.

The patient, a man thirty-one years old, was under my care in the hospital fourteen months. He had always been strong and had a good family history: Two and one-half years before coming under my care he had contracted syphilis. Eight weeks before his admission into the hospital he had taken a course of inunctions. At the examination the internal organs appeared normal and there were no signs of a recent or past syphilis. Examination of the nervous system showed a spastic paresis of the lower extremities. While the increase of the tendon-reflexes was always considerable, the degree of muscle tension in passive motion varied considerably; the active movements of the lower extremities likewise were subjected to considerable variation. The gait was a typical spastic one. Sensation in the region of the lower limbs was slightly affected in that sense of position in the toes and the ability for localization on the feet and legs was disturbed; otherwise sensation was normal. Ataxia and Romberg were not present. No other anomalies of the body or upper extremities were observed. During the following six months the patient was given a combination treatment of mercury and potassium iodid. He complained often of lancinating pains radiating from the back and loins down into the thighs. The bladder weakness which expressed itself in frequent urination and enuresis improved slightly. The spastic paresis with slight remissions gradually increased. The disturbance of sensation remained unchanged. Six months later the sensation in the lower extremities had grown worse in that all the

qualities were affected. The spastic symptoms were severe. The patient was only able to drag himself around in his room by the aid of two canes with difficulty. When he attempted to move his limbs in bed involuntary muscle spasms appeared which produced a marked tremor in the legs. Thorough and continued treatment made practically no change in the patient's condition and he was finally discharged from the hospital.

In this case we may assume that it was one of meningo-myelitis which was localized in the lower dorsal and lumbar regions. The radiating pains indicated an involvement of the meninges. The secondary involvement of the medullary fibres had caused an irreparable injury to them with a descending secondary degeneration. Whether a primary arterial disease with the consequent thrombotic softening of the medullary substance existed was not able to be definitely determined.

**The Course of Meningomyelitis.**—The course of meningo-myelitis is a varied one. Usually the disease begins chronically and continues chronic in character, yet now and then it sets in acutely with a motor paresis of one or more extremities. Generally the course is uninterrupted and progressive, but not infrequently it may become quiescent and remain so for months and even years. Intermittent improvement also sometimes occurs.

In addition to the motor improvement, sensation and the disturbance of the bladder functions may improve wonderfully. In some cases the improvement is only a temporary one and a relapse occurs; in others it is permanent; in still others contractions develop which follow as a consequence of the myelitic lesion and the secondary degenerations arising from it.

There are a small number of cases which grow progressively worse and exhibit a complete paralysis, both of sensation and motion. In these cases death is usually caused by the severe decubitus and the injurious effects of the severe bladder paralysis on the bladder and kidneys.

At any stage the chronic paraparesis may be transformed by an acute attack into a complete transverse

paralysis, or in other words, the chronic myelitis may suddenly be changed into a transverse acute myelitis.

**Erb's Syphilitic Spinal Paralysis.**—The most common form of spinal-cord syphilis is that of complete transverse dorsal myelitis which Erb, in 1892, described in the following manner:

**Erb's Definition.**—"Several years after a specific infection, the slow and gradual development of a spastic paresis of the lower extremities with spastic gait, motor paralysis, slight muscle tension, slight increase of the tendon-reflexes, sensory disturbances either slight, severe, or absent, and bladder weakness. The upper extremities as well as the intelligence, the cranial nerves, and the pupils remaining normal."

Such observers as Kuh, Gerhardt, Mendel, and Lamy have acknowledged Erb's clinical description as characteristic of spinal syphilis, but have also pointed out the fact that this symptom-complex is found in other affections of the cord. Oppenheim, Leyden, and Goldschneider have expressed the view that Erb's symptom-complex is only a stage in syphilitic meningomyelitis. From Erb's original work it is evident that he allows to the borders of specific spinal paralysis a fairly wide latitude. On the one hand we see the almost pure type of spastic spinal paresis, a slowly developing spastic paresis of the lower extremities with slight contractures, entirely lacking or only slightly indicated sensory disturbances, almost entirely normal bladder and sexual functions; on the other hand we see subacutely appearing motor paraplegias with muscle contractures and increased tendon-reflexes, rather marked objective sensory disturbances with impotence, severe sphincter disturbances, and myelitic decubitus.

The time of the beginning of the disease after the infection likewise comes within wide borders, one and one-half to twenty-four years.

The pathology of Erb's symptom-complex has been formulated by him and his pupil Sidney Kuh, without the corroboration of an autopsy, however, as follows: A partial transverse lesion is assumed and a symmetrically situated



affection of both halves of the cord. The root regions of Burdach's columns are not involved; the posterior parts of these columns, together with the lateral and pyramidal tracts, are affected; the posterior gray columns and the posterior white tracts are also involved; the anterior half of the cord remains intact; perhaps the cerebellar tracts and the columns of Goll are affected.

The degeneration depends upon a syphilitic infiltration of the medullary substance, or a luetic change which originates from luetic disease of the arteries. Through this arterial disease Erb explains the sometimes rapid, sometimes gradual beginning of the affection, also the remissions in the course of the disease and the usually only partial success of the therapy.

The position of Kuh in his comprehensive work on this subject is against the assumption of a primary sclerosis. His argument is that a primary sclerosis in the spinal cord appears only a long time after the infection and would not be influenced by antispecific therapy. It is certainly true, as Kuh remarks, that the cases with an acute beginning and the cases where myelitis develops early are not due to a sclerosis, but it must also be admitted that this objection does not apply to the great majority of cases of "syphilitic spinal paralysis" which develop gradually, and slowly, and that further, in many cases the treatment does not produce any marked remission and that such remissions may be observed spontaneously in sclerosis.

At the present time the pathological examinations of the cases of "syphilitic spinal paralysis" which have come to autopsy have pretty definitely settled that the pathology of the uncomplicated forms of Erb's paralysis is a primary combined system disease without any particular disease of the arteries and without meningitis. It has also been determined that the clinical picture of spastic spinal paralysis with slight weakness of the bladder and trifling involvement of sensation occurs both in syphilitics and non-syphilitics, and in both the pathological basis for the symptoms is due to a combined system disease in the lateral columns (cross-pyramidal tracts) and the columns of Goll.

The symptoms of syphilitic spinal paralysis may appear early. In the 22 cases reported by Erb, 13 began within the first three years after the infection. In three of my own cases, one developed in the twenty-fourth year, one in the sixth, and one a year and a half after the infection. In the light of our present knowledge, both clinical and pathological, one is able to form some definite conclusion with reference to "syphilitic spinal paralysis."

1. There are without doubt cases that present the symptom-complex which Erb has described for many years until death. There are also cases in which the symptom-complex represents not only a "syndrome" but the disease itself.

2. The pathological basis of this affection is due either to primary combined tract affection in the posterior and lateral columns without specific disease of the cord, in which case it can be regarded either as a true system affection or tract disease arising from a chronic myelitis, whichever one may choose to regard it, or its pathological basis consists of this same tract disease in combination with a diffuse chronic myelitic process in which the spinal-cord arteries are involved with an arteritis of Heubner's type, the meninges are affected to a greater or less degree.

According to our present experience the latter form is the most frequent.

3. It is further true, that in many cases Erb's symptom-complex forms only the basis of the clinical picture, which finally ends either in spastic contractures or incomplete transverse myelitis. In such cases the symptom-complex represents only a syndrome. In these cases we have pathologically on the one hand a pure type of sclerosis of the lateral columns in which arterial changes of the specific variety do not belong and in which a more or less extensive chronic myelitis may occur, and on the other, either a primary combined tract disease in conjunction with a more or less extensive myelitis only, with ascending and descending degenerations.

Finally we are confronted with the question as to whether this symptom-complex is so characteristic that in

all probability its presence means the existence of a syphilitic process in the spinal cord. Erb answers this question in the affirmative. Leyden and Goldschneider on the other hand do not regard it as pathognomonic of lues and claim it may be observed in diffuse non-specific affections of the cord.

According to my own experience I do not believe that the typical form occurs except from a specific origin, but I do believe that as soon as the bladder symptoms and disturbances of sensation become more severe and muscle rigidity is added to the clinical picture, the differential diagnosis from multiple sclerosis, extramedullary tumor, and pseudo-system disease such as is found in anæmias becomes extraordinarily difficult.

## XII

### SYPHILIS OF THE SPINAL CORD

**Acute Specific Transverse Myelitis.**—Syphilitic spinal-cord paralysis may run an acute course from its very beginning, and the chronic type of specific myelitis may also develop into an acute transverse myelitis at any time. The acute transverse myelitis is not an infrequent form of spinal syphilis.

**Frequency.**—Orlowsky, in 72 cases of spinal syphilis, found the acute type in 19 cases. In 92 cases in my private practice and 120 hospital cases I have observed in the former 3 cases and in the latter 5 cases of acute myelitis.

**Mode of Appearance.**—The transverse paralysis either develops very quickly, in a few hours the lower extremities becoming paraplegic, or it requires several days for its complete development. The paralysis is almost always an absolute one, so that from the pelvis down all voluntary motion is gone. According to the level of the lesion in the cord the lower extremities alone are involved, or in a higher lesion a portion of the body as well. The upper extremities are rarely affected.

**Sensation.**—Sensation is usually severely affected. Either all the qualities of sensation are gone or individual qualities, especially the temperature sense over a varying degree of surface, may be preserved; also the sense of touch may be retained. Thermo-analgesia may sometimes represent the only sensory disturbance.

Acute specific myelitis may present the Brown-Sequard complex for longer or shorter periods in the course of the disease.

The tendon-reflexes are abolished when the lesion is located in the lumbar cord, or preserved or increased when situated above the centres for these reflexes. The sphincters of the bladder and rectum are from the beginning severely involved. In many cases œdema quickly makes its



appearance in the paralyzed parts and decubitus developing in the sacral region and rapidly progressing is a frequent occurrence.

In a few cases the paralysis appears when the patient is apparently in complete health. In the majority of cases, however, premonitory symptoms precede the appearance of the paralysis. The paralysis usually appears in an individual who although limited in his ability to work is still able to go around.

**Prodromal Symptoms.**—Rosin divides the prodromal symptoms into sensory and motor symptoms and disturbances of the functions of the bladder and rectum. The sensory symptoms consist in paræsthesias and radiating, shooting, and boring pains in the lower extremities, in the hips and in certain parts of the trunk and spinal column, also a certain stiffness of the back. Sensitiveness to movements of the trunk may be mentioned here. These are the symptoms of spinal irritation upon which, many years ago, Charcot laid great weight, and more recently Oppenheim has again pointed out as of frequent occurrence and relatively characteristic.

The motor prodromal symptoms manifest themselves not only as irritative symptoms but also as symptoms of paralysis as well. Twitchings and spasm-like movements of the toes, feet, and legs alternate with weakness and with actual paretic conditions.

Very often, as Williamson especially has called attention to, disturbance of the bladder and rectum in the form of retention precedes the appearance of the transverse paralysis.

Rosin claims, after a review of the literature on this subject, that a prodromal stage may often be recognized from the behavior of the patellar reflexes, which change at different times from being increased, then to normal and diminished. These prodromal symptoms last in many cases not only days and weeks, but months, and even years. Their specific nature may be indicated to the careful observer by their fleeting character and tendency to recover.

**The Course.**—In the well-developed form of the disease,

relatively frequent in comparison to the non-specific type of transverse myelitis, a variation in the degree of paralysis of both sensation and motion occurs. An improvement may take place entirely independent of the therapy which lasts for days and weeks and then disappears. The disease usually runs a rather rapid and fatal course.

Schmaus reports a case which terminated in death after fourteen days, Williamson one after fifteen days, Goldflam two cases which ran courses of four and six weeks, respectively.

Case of acute specific myelitis of the lumbar cord: A woman, forty-six years old, had contracted syphilis ten years previously and had received treatment for it at two different periods.

Two years before her present illness, after several weeks of prodromal symptoms in the form of girdle-pains and pains radiating down the limbs, she became suddenly paralyzed in the lower extremities. This paralysis cleared up in the course of a few weeks under the administration of potassium iodid, with the exception of some weakness which still remained in the limbs. The patient was able to resume her work for a space of two years, until one day, without any external cause, with sharp pains in the limbs and back, she again became paralyzed. This time there was a complete motor and sensory paralysis, with loss of the reflexes and paralysis of the bladder and rectum. Decubitus quickly appeared and rapidly progressed, and the patient died, with symptoms of sepsis, in two months' time. At the autopsy as stigma of an earlier lues considerable atheromatous degeneration of the beginning aorta, the picture of Heller's aortitis was found. The brain was normal. In the lumbar part of the spinal cord the dura and pia were adherent. The cord-substance was soft, almost pulpy.

The microscopical examination showed the anterior and posterior spinal arteries, as well as all the arteries in the anterior, and some in the posterior roots affected with a severe arteritis of the Heubner type. In many of the vessels the size of the lumen was reduced to a minimum. The vessels in a transverse section of the lumbar cord were

markedly increased. The walls of all were thickened and the lumina narrowed and in some instances obliterated entirely. Above the lesion there was recent secondary disease of the columns of Goll.

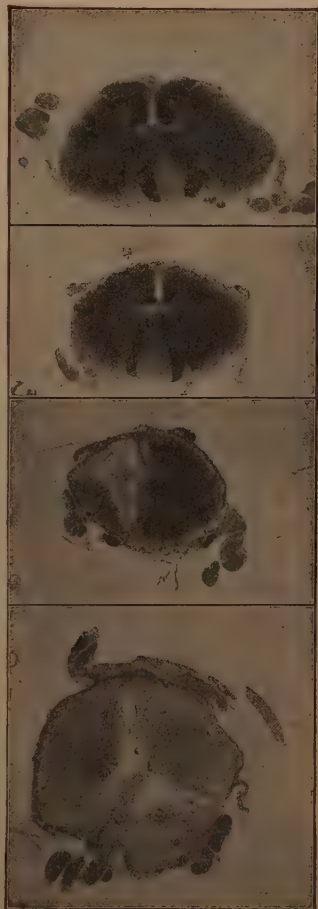
Genuine inflammatory symptoms were absent, also gummatous disease. The pia mater was more or less strongly proliferated and thickened. The disease of the vessels was apparent in all the different levels of the cord where transverse sections were made, but most marked in the lumbar region.

The proliferation of the pia the higher up one got gradually grew less, until finally in the cervical region it was not to be observed.

This case presents a typical example of acute specific myelitis. Two years before, the process had given serious warning in the prodromal symptoms above described. Then suddenly a transverse softening appeared as a result of disturbances of nutrition caused by severe disease of the vessels. This process was irreparable.

In the majority of cases cystitis and decubitus in those completely paralyzed cause death in a few months.

In rare cases, by careful attention, life may be preserved for a long time. In one of my cases, which was completely paralyzed from the navel down, in spite of a total paralysis of both bladder and rectum, it was possible, by scrupulous care, to keep the cystitis and decubitus within reasonable limits and to prolong life for ten years. The patient finally died of laryngeal carcinoma.



FIGS. 56-59.

Sometimes marked and lasting improvement is observed, as in the following case:

A woman, forty years old, with a previous history of lues, had, three months before I saw her, without any premonitory symptoms or any demonstrable cause, developed a severe motor paralysis of the lower extremities, with total paralysis of the bladder and rectum. Decubitus on the hips appeared. Cerebral symptoms were absent. Objective sensory disturbances were absent. Energetic mixed treatment was administered, and with such a degree of success that after three months the patient was able to walk with the aid of a cane. Her condition at the present time, after three years, remains about the same, namely, typical spastic paresis of the lower extremities, with weakness of the bladder and rectum.

In this case premonitory symptoms were entirely absent, likewise the incongruence between the motor and sensory paralysis with sphincter involvement was marked.

**Differential Diagnosis, Tuberculosis.**—In the differential diagnosis those cases in which some other infection or intoxication can be demonstrated are to be excluded. Not infrequently differential diagnostic difficulties occur in the form of an acute transverse myelitis that takes place as a result of spinal caries and the tubercular exudate produced by it. Prodromal symptoms here also are usually present for a longer or shorter period. The characteristic gibbus formation may not always be present. In such cases the Röntgen ray is of decided advantage. Tuberculosis of the spinal column, however, usually exhibits the clinical picture of a gradual compression, and almost always—exceptions do sometimes occur—elsewhere in the body tuberculosis can be demonstrated. The history of a previous syphilitic infection does not exclude tuberculosis. In general, it may be said that tuberculosis can be excluded in an acute transverse myelitis when in a patient who previously has had syphilis neither symptoms of tuberculosis can in other portions of the body be found nor caries of the spine demonstrated.



**Malignant Tumor.**—The differential diagnosis is still more difficult in those rare cases of malignant tumor of the vertebral column in which the tumor extends from the spine to the meninges, surrounds the cord, and leads to a transverse softening. If there is a previous history of syphilis in such cases a wrong diagnosis is almost inevitable.

**Spinal Apoplexy.**—Finally one must take into consideration those rare cases of spinal apoplexy in which entirely acute with prodromal symptoms of only a few hours' duration a complete transverse paralysis occurs in a previously entirely healthy person and without any demonstrable cause. The following is such a case:

The wife of a school teacher, thirty years old, was suddenly one night seized with pains in the back which radiated down into the limbs. The next morning she could only with difficulty move her limbs, and by noon on the same day was completely paraplegic in both the motor and sensory functions, including a paralysis of the sphincters. This condition has existed for six years without any variation. One must assume in such cases that a spinal-cord hemorrhage exists, the cause of which is not clear, analogous to the hemorrhage which sometimes occurs in the brain of young and healthy persons.

**Pathology.**—The pathology of acute paraplegia in syphilis may embrace the meninges and spinal cord together, or either one alone. In the majority of cases the pathological findings indicate syphilis. Occasionally cases are encountered where there is nothing to distinguish between specific and non-specific myelitis. One finds in the meninges either only disease of the blood-vessels, such as is usually found in specific affections, or accompanying this also inflammatory infiltrations around the vessels, or in addition to a well-marked meningitis both pachy- and lepto-, sometimes gummatous processes.

The spinal cord itself shows a greater or less degree of arterial disease.

Irregular foci of softening, or sclerosis, or a large transverse lesion which is usually situated in the mid-dorsal region, or a necrosis of the gray matter along with changes

in the white matter, or the penetration of gummatous masses from the meninges into the white substance, or, finally, the chief pathological lesion may consist of a hemorrhage in the gray matter with secondary necrosis of the same. At the same time one finds in the arteries endo-, peri-, and mesoarteritis. Sottas found in the walls of the arteries even, small gummata. Thrombosis of both the larger and smaller spinal arteries, and also thrombosis of the endo- and periphlebitic affected veins is of common occurrence. The foci of softening are found most frequently in the periphery of the lateral and posterior columns and next in frequency in the anterior gray matter.

In the majority of cases the pathology consists of a combination of the different above-mentioned changes, a varied admixture of vessel disease and its consequences, inflammatory and less frequently specific gummatous infiltrations. In addition to these processes there is also an ascending and descending degeneration.

The pathology explains in the best way the clinical picture, and especially it explains those features which strike one as differing to a greater or less degree from the ordinary acute myelitis.

The prodromal symptoms, the spinal rigidity, the pains in the back, the sensory and motor symptoms of irritation in the extremities, which vary in intensity and localization, are best explained by the slow and intermittent development of the infiltration and inflammation of the meninges. The fact that the spinal cord remains for so long a time apparently intact is partly for the reason that the formation of thrombosis and the production of impermeability in the blood-vessels requires time, even though they may be severely affected, and partly because vessels which are not involved or only slightly involved may act as compensatory.

**The Incongruence Between the Pathology and the Clinical Symptoms.**—The relative frequent incongruity between the motor and sensory paralysis may be explained by the involvement or non-involvement of the arteries which supply the motor and sensory areas of the cord. The circumstance that the localization of the final paralysis does not always

correspond to that of the prodromal symptoms depends on the fact that the meningitic process is independent of the thrombotic formation in the vessels.

**Simple Acute Myelitis in Syphilitics.**—Cases of acute transverse myelitis have occasionally been reported in syphilitics as occurring shortly after the infection in the early secondary stage, which pathologically cannot be differentiated from the ordinary myelitis of softening. The following case is of this form:

A seaman, thirty-nine years old, two years after a specific infection and four weeks after a slight injury to his back, became acutely paraplegic. He was bed-ridden in my department at Oppendorf for eight years with all the symptoms of a complete transverse lesion in the lower dorsal region, and finally died of a pneumonia. The microscopical examination of this case showed a simple degeneration of the entire transverse cord from the eighth to the eleventh dorsal segments. There were no specific changes either in the cord or membranes and only a simple thickening of the walls of the vessels.

Savard called attention in 1882 to the not infrequent occurrence of a simple acute myelitis in persons with a specific history in which other etiological factors could not be demonstrated. Oppenheim, in his well-known work concerning acute myelitis, has also attributed to syphilis an etiological rôle which causes a different pathology than that of the specific changes which have been described. This pathology is produced primarily by the toxin of the disease. These cases are not cases of spinal-cord syphilis but cases of acute myelitis depending upon a syphilitic basis.

In this connection the following case is of interest:

A lawyer, forty-five years old, had contracted syphilis twenty years before and had been thoroughly treated for it. The patient had been married fifteen years and had four healthy children. He was taken sick with paræsthesias in the lower extremities and slight dysuria. Because the pupils did not react promptly and the tendon-reflexes were difficult to obtain, I diagnosed the case as one of beginning tabes and sent the patient to Olynhausen. Here, while

undergoing a course of inunctions, severe pains appeared in the neck, which were accompanied by a rapidly increasing motor weakness of the lower extremities. The patient was taken home and the picture of a rapidly developing complete transverse dorsolumbar myelitis was presented. Paralysis of the bladder, with the resulting cystopyelitis, and some decubitus were also present.

As the pains in the neck did not yield, and also a certain amount of stiffness in the neck existed on passive motion, and as energetic antispecific treatment proved of no avail, the probability of a rapidly growing extramedullary tumor was considered and the patient subjected to an exploratory laminectomy with a negative result. Death followed soon after the operation.

The diagnosis before the autopsy was made of *tabes dorsalis* and *meningomyelitic lues*.

The autopsy revealed in the middle and lower cervical and upper dorsal a rather marked leptomeningitis, which microscopically was still of an acute inflammatory character, but did not show any gummatous processes. On transverse section of the cord incipient *tabes* was found to be present. Otherwise, with the Weigert and borax-carmin stains, no other anomalies were found. There was neither syphilitic nor other disease of the vessels worth mentioning, nor an acute or subacute change in the nervous parenchyma.

In this exceedingly remarkable case one is also forced to the assumption that a severe toxin caused the serious disturbance of function in the cord. Figs. 60-64 are from preparations taken from this case.

It is not altogether improbable that preparations stained according to the Marchi method might have disclosed alterations in the parenchyma. At any rate the case is instructive in showing the striking incongruity which can exist between the clinical symptoms and the pathology.

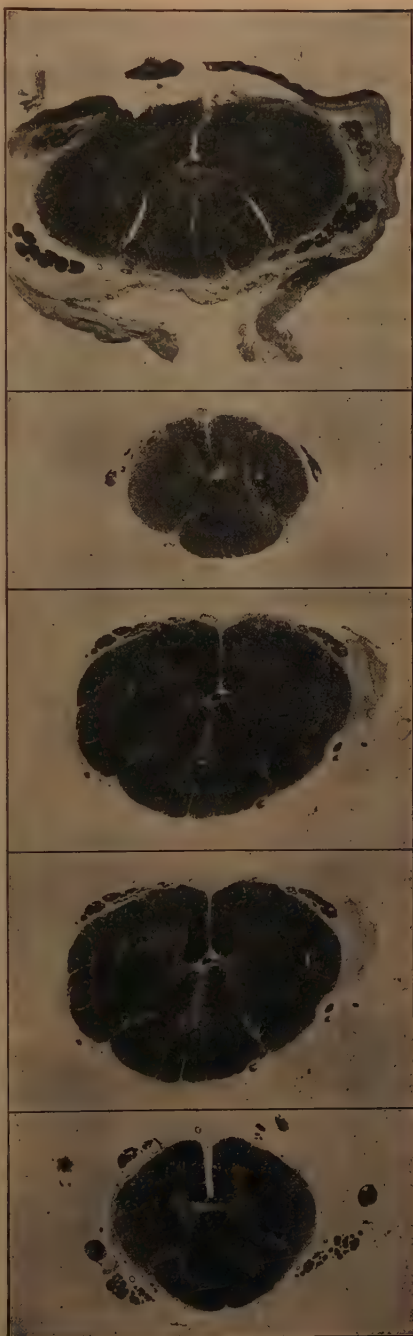
**Landry's Paralysis.**—It is still a matter of controversy whether in individual cases syphilis may be responsible for the clinical syndrome of Landry's paralysis. Numerous cases have been reported by different observers which would seem to indicate that it may be. Heubner, from his own



experience and also the observations of others, assumes that there is a syphilitic form of Landry's paralysis which appears in the early stages of syphilis without either prodromal or meningitic symptoms. It may be considered the exception rather than the rule that cases of acute ascending spinal paralysis without any pathology have any connection with syphilis.

**Disease of the Anterior Gray Substance.**—The anterior gray matter is frequently affected, but usually only in conjunction with a myelitis which extends over the cord transversely. The involvement of this part of the cord is manifested by atrophic paralysis with quantitative and qualitative changes in the electrical responses.

The pathology is that of a simple shrinking and atrophy of the ganglion-cells and their axis-cylinder processes, as well as a necrosis of the network of the medullated fibres; occasionally a deposit of round cells is found. Jarisch believes in the cases



FIGS. 60-64.

of children with evident syphilis, where he has had an opportunity to examine the spinal cord, that he has found the ganglion-cells in the gray matter reduced in size and number and the protoplasm changed. Whether this finding can be regarded as pathological, and whether there is any relationship between it and florid syphilis, is uncertain.



FIG. 65.—Poliomyelitis anterior chronica, choroiditis luetica.

Cases of poliomyelitis subacuta have been reported in syphilitics, but in such cases as came to autopsy the pathological picture did not differ from the usual atrophy of the cells in the anterior horns and exhibited nothing characteristic of syphilis.

I have observed three cases, one in a woman and two

in men, who wereluetics, in which the clinical symptoms presented were those of a chronic progressive anterior poliomyelitis. In all three cases only the upper extremities were affected, in two cases active symptoms of syphilis were present, and in all three cases, after a protracted anti-specific therapy, the disease became quiescent.

In the woman the disease ceased to progress after the

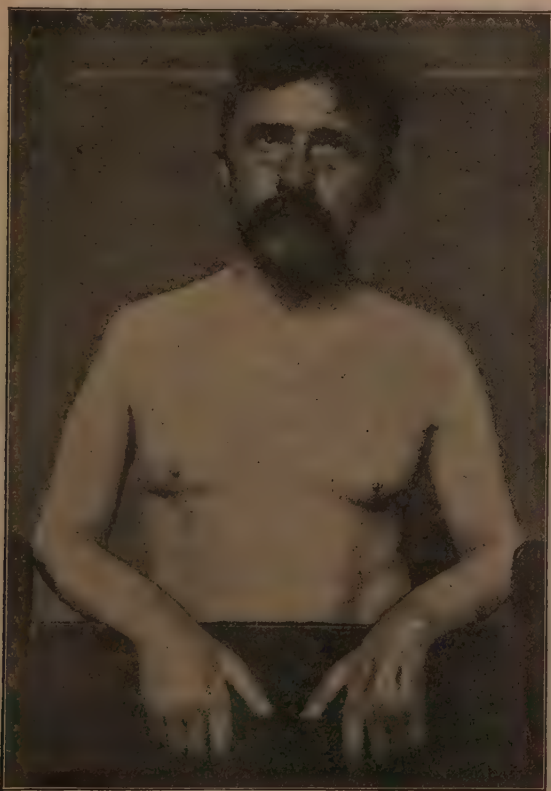


FIG. 66.—Poliomyelitis anterior chronica (lues previously). The upper extremities are completely paralyzed and atrophic.

muscles of the hands, the forearms, and arms had become completely paralyzed and atrophic (Fig. 65). In one of the men the atrophic paralysis involved the shoulder-girdle and a portion of the arm and forearm musculature. In the other the upper extremities in their entirety were affected. There were no sensory symptoms in any of the cases. All signs of amyotrophic lateral sclerosis were absent.

In these three cases, fourteen years in the first, twelve years in the second, and six years in the third have elapsed since the disease became quiescent. While in these cases it is by no means settled that syphilis was the cause of the progressive atrophic paralysis, nevertheless, in the absence of other etiological factors, one can at least feel that syphilis furnished the predisposition to the disease of the spinal motor neurons.

**Amyotrophic Lateral Sclerosis.**—There is nothing in the literature concerning syphilis as a causative factor of amyotrophic lateral sclerosis.

**Syringomyelia.**—We have already seen that isolated atrophic paralyses occur in syphilis, also that in spinal syphilis frequently only individual qualities of sensation, particularly the qualities of temperature and pain, are affected. It is not to be wondered at, then, if occasionally the clinical syndrome of syringomyelia is presented. This can occur whenever a syphilitic tumor involves both the anterior and the posterior gray matter. Also it is known that cavity formations occur sometimes both in cases of compression and traumatic myelitis.

In chronic specific myelitis and meningomyelitis not infrequently one finds irregularly distributed atrophic parapareses and paraplegias and a more or less sharply defined disassociation paralysis of the qualities of sensation. The sensory boundaries, however, are of the same form as those found in myelitis and not the characteristic amputation type occurring in syringomyelia. The development is also different in that the disease does not begin with atrophic pareses which gradually progress, followed by sensory disturbances after previously the well-known disturbances of nutrition on the distal parts of the upper or lower extremities have appeared. In short, there is lacking the regular sequence of the classical triad in syringomyelia.

In 1897 E. Schwarz, of Vienna, demonstrated sections of a case of specific myelomeningitis with cavity formation in the cord. In the lower cervical and in the middle and lower dorsal regions in the anterior horns on both sides cavities were found whose walls showed no signs of gliosis,



but were covered with a thick homogeneous covering. This homogeneous mass was regarded by Schwarz and also Schlesinger as due to a beginning degenerative process in the glia, analogous to that occurring in syringomyelia and probably caused by the same arterial changes, which both Schlesinger and A. Westphal also make responsible for the fusing together of the gliosis-like formation in syringomyelia.

In this case, which pathologically can be considered as a combination of meningomyelitis and syringomyelia, the clinical symptoms of the latter were absent.

**Central Gliosis with Disease of the Posterior Columns.**—Numerous observers, as Jegorow, Eisenlohr, Nonne, and

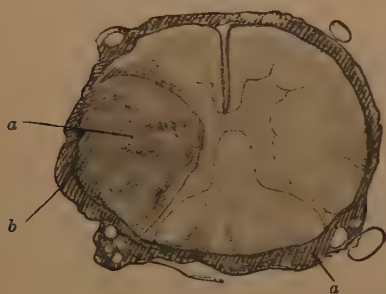


Fig. 67.

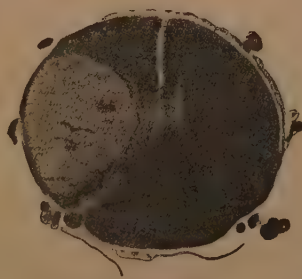


Fig. 68.

**FIGS. 67-68.**—Chronic syphilitic meningomyelitis. The myelitis has extended from the pia mater to the substance of the cord. (Personal observations.) *b*, chronic inflammatory proliferated pia mater; *a*, myelitic changed lateral columns.

Oppenheim, have reported cases with a combination of tabetic posterior column sclerosis and central gliosis with and without cavity formation. These authorities unite in assuming a relationship between the proliferation of the glia, the tabetic disease of the posterior columns, and the central gliosis, in that the gliosis possesses either the tendency to unite with the processes of degeneration in the posterior columns or it develops from the glia-proliferation, appearing secondarily as the result of the tabes.

**The Brown-Sequard Symptom-complex.**—Syphilis of the spinal cord manifests itself very often under the form of a unilateral lesion. Petren, in 1902, was able to collect 34 cases of spinal syphilis which presented the Brown-Sequard syndrome.

When one stops to consider the diversity of specific lesions which may affect the spinal cord, it is easy to understand the frequency of occurrence of the unilateral lesion. It will also be easy to comprehend that the unilateral lesion will not be presented in the purity in which we see it after injuries, hemorrhages, and non-syphilitic tumors, for in such conditions the capriciousness of the specific growth and the metamorphosis is absent.

The following case is an unusually pure form of the Brown-Sequard type of paralysis:

The case is one of a servant girl, twenty years old. Four weeks before her admittance into the hospital she was seized with severe pains in the left lower part of her body, which were girdle-like in character but radiated chiefly to the left side. At the same time she noticed a weakness in her right leg. At the examination a weakness of the entire right lower extremity and a diminution in the pain and temperature sense in the left leg were found. The disturbance of sensation extended on the left side to the lower part of the abdomen in front and the nates behind. Above the upper border of this sensory disturbance there was a narrow zone of hyperæsthesia. There was also a slight disturbance of the bladder and the absence of the patellar reflexes on both sides.

The pupils were unequal, did not react to light, and were slow in their convergence reaction. The ophthalmoscopic findings were normal. Further objective symptoms either in the internal organs or nervous system were not observed. History of syphilis was indefinite.

Symptomatic therapy failing to accomplish anything, mercurial inunctions were begun and from the fifth day on both the motor and sensory paralysis began to improve.

The diagrams show the rate at which the sensory disturbance receded.

The only objective symptoms remaining after twenty-one days were the absent patellar reflexes.

Regarding the unilateral lesion Mitchell Clark goes so far as to say—in my opinion, too far—that its origin is either traumatic or syphilitic. A review of statistics shows

that this lesion is usually a chronic one, although it may have an acute beginning. In the majority of cases all the qualities of sensation on the contralateral side are not



Fig. 69.



Fig. 70.



Fig. 71.

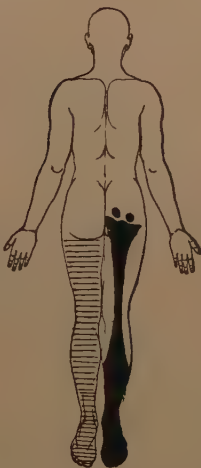


Fig. 72.



FIGS. 69-72.—1, left, motor paralysis; right, skin anesthesia for temperature and pain; 2, seven days after the administration of the inunctions; 3, nineteen days afterward; 4, twenty-one days afterward. Motion and sensation on both sides normal. Patellar reflexes on both sides absent.

affected, and those involved are more frequently diminished than entirely abrogated. The disturbance of motion is more often a paresis than a paralysis. Corresponding to

the more frequent localization of syphilis in the dorsal cord the unilateral lesion is confined in most instances to the involvement of the lower extremities. The atypical form of the syndrome often is manifested by an involvement also of the motion on the opposite side and *vice versa* disturbance of the sensation on the paralyzed side.

The following sections (Figs. 73-78) are taken from the cord of a man, forty years old, who, ten years before the beginning of his spinal affliction, contracted lues.

This patient had a disturbance of the bladder and a slight paresis of the limbs, with a suggestion of the Brown-Sequard type, inasmuch as the spastic paresis on the right side was more marked than on the left side, and on the left side a slight hypo-æsthesia for touch and pain existed. The symptoms did not react to antispecific therapy. Death in this case was the result of a pneumonia.

Experience has shown us that cases of syphilis presenting this clinical syndrome are usually benefited and often cured by antispecific treatment.

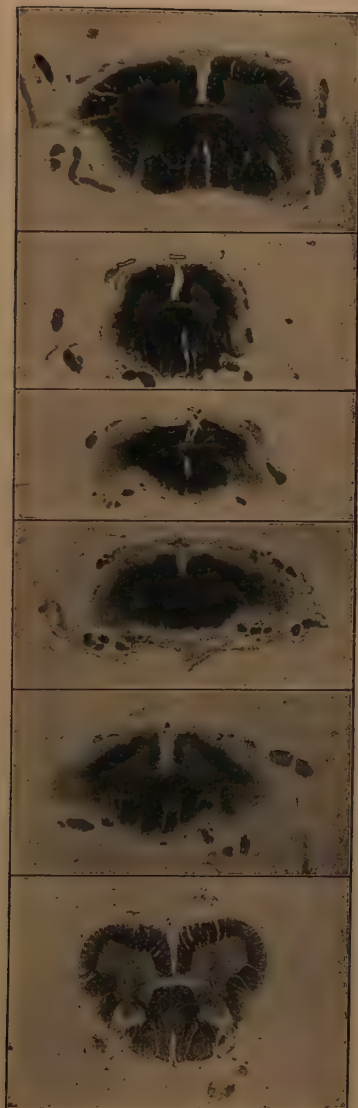
There are exceptions to this rule, however. It depends largely upon the nature of the changes as to whether they are syphilitic or postsyphilitic.

In the cases which recover, or partially recover, in later years aluetie or metaluetic disease may develop elsewhere in the cord, as in the following case:

A man who, two years before, had contracted syphilis, was admitted to the hospital with a motor paresis of his right limb and increased patellar reflexes. He complained of some pain and aggravating paræsthesias in the other limb. Sensation was not affected in either leg. These symptoms, under antispecific therapy, disappeared. Two years later the patient again presented himself, complaining of an insecurity in his limbs. Examination demonstrated a typical tabes, which was uninfluenced by treatment and rapidly progressed, terminating in a taboparesis.

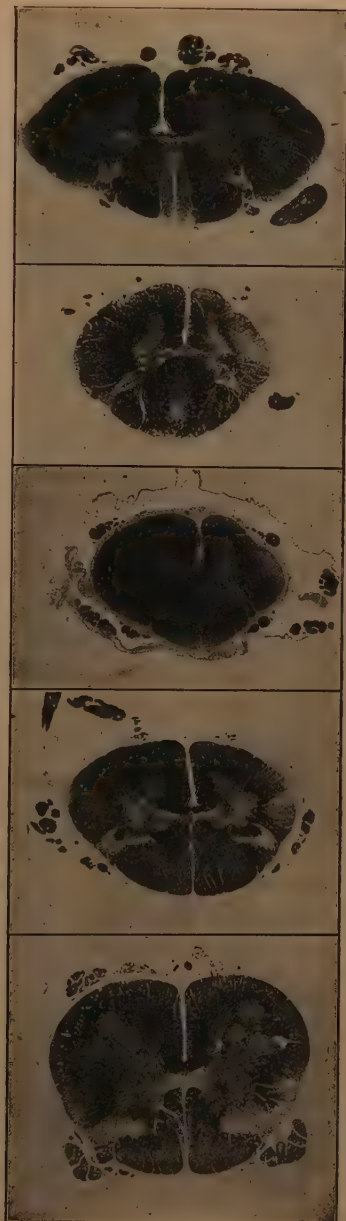
**Symptoms of Multiple Sclerosis.**—The picture of multiple sclerosis, as it has been described by Charcot and as it is presented in typical form in the clinics, will scarcely be pro-





Figs. 73-78.

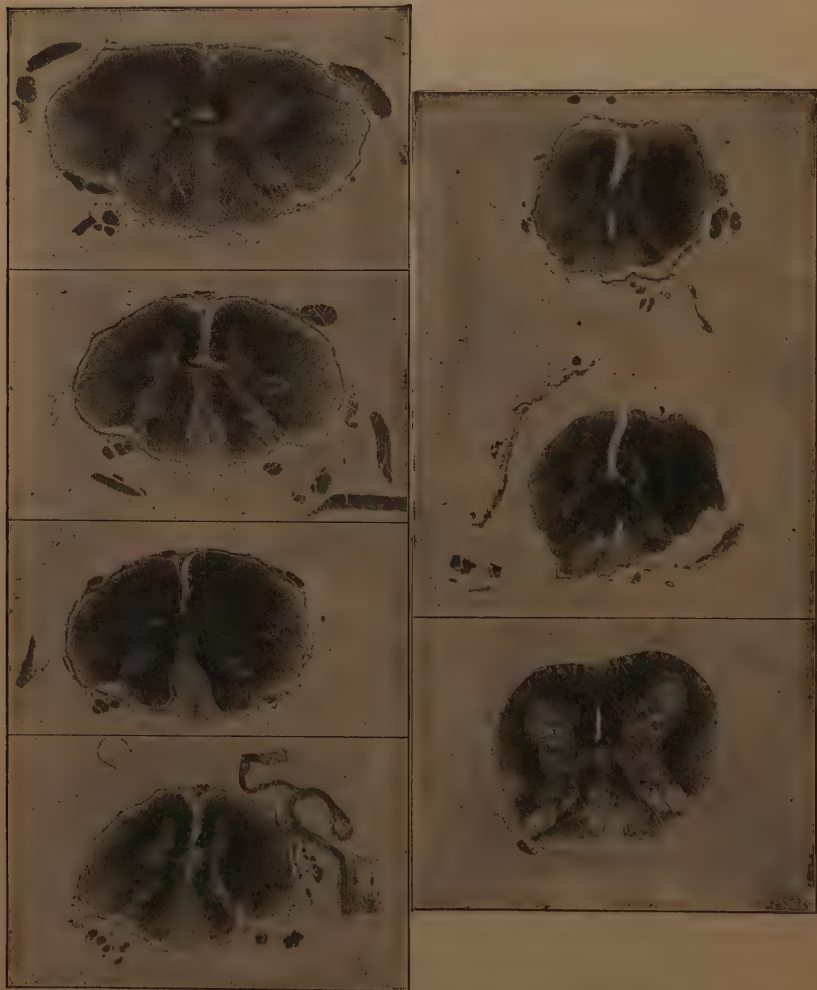
FIGS. 73-78.—(Personal observation.) Spastic paraplegia inferior, chronic dorsal myelitis, with incomplete Brown-Sequard.



Figs. 79-83.

FIGS. 79-83.—Combination of incipient tabes with chronic dorsal myelitis. (Brown-Sequard.) (Personal observation.)

duced by syphilis, although in the multiple lesions which it causes in the central nervous system it resembles syphilis. The course, however, is a different one and the symptoms, which still are regarded as pathognomonic, such as the



FIGS. 84-90.—Two cases of combined system disease inluetics. (Personal observation.)

scanning speech, oscillatory nystagmus, and intentional tremor, are not observed in nervous syphilis. Syphilis also does not appear to be a factor in the etiology of multiple sclerosis.

The spinal type of multiple sclerosis (*formes frustres*) is often difficult of differentiation from specific myelitis. This subject will be taken up later in the general consideration of the differential diagnosis in syphilis of the spinal cord.

**Symptoms of Tumor.**—One can consider the possibility of gummatous tumor of the spinal cord in those cases in which the Brown-Sequard syndrome is well developed or where an increasing compression of the cord exists along with severe symptoms of sensory irritation, or where a circumscribed subacute anterior poliomyelitis develops. Such cases have been described by Osler, Orłowsky, Gowers, and Williamson. The tumor symptoms in these cases are



FIG. 91.

naturally the same as are caused by other tumors, as, for example, an intramedullary tubercle reported by Sachs. It must be remembered, however, that these tumor symptoms can be produced by the cone-shaped gummatous proliferations which penetrate into the cord, also that chronic myelomeningitis cannot be differentiated from circumscribed gummatous tumors, because with the tumors either localized or diffuse meningitis is always an accompaniment. In general, one can think of the possibility of a gumma whenever the symptoms of an extra- or intramedullary tumor are presented.

**Symptoms of Combined Tract Disease.**—One appreciates *a priori* that disease of the vessels in spinal lues through their different localizations can cause the clinical syndrome

of combined tract disease, and also that meningitis involving the cord secondarily may attack the posterior and lateral columns in different combinations.

Our experience in "syphilitic spinal paralysis" has taught us that the primary combined system disease in the form of degeneration of the cross-pyramidal tract and other tract systems in the lateral columns, together with disease of the columns of Goll, occurs.

The cross-pyramidal tracts may also degenerate primarily alone.

The formerly generally accepted view that syphilis does not cause system disease, in the light of our present knowledge, does not hold good.

What Pierre Marie calls the vascular form of system disease is by far the most frequent, a pseudosystem affection developing from an existing localizing meningo-myelitis.

The following case is such a one reported by Dreschfeld in 1888:

A patient, sixteen and a half months after a specific infection, while he still presented secondary symptoms, developed a spastic paraparesis of the lower extremities, which were ataxic and also showed slight sensory disturbances. The bladder was also paralyzed. The upper extremities were not involved. Some time after antispecific therapy had caused a marked improvement, the patient died from a cystopyelitis.

The pathological examination demonstrated a diffuse sclerosis of the posterior lateral and anterior pyramidal tracts, as well as of the gray matter in the lower portion of the dorsal cord. At the same time there was an ascending degeneration of the column of Goll and a partial one of Burdach's column and the lateral cerebellar tracts. In the sclerotic changes there was a well-developed peri- and endoarteritis and perivascular infiltration. The pia was not affected.

Recently Renner published a case with the pathological examination. There existed, after prodromal pains in the limbs, ataxia in the arms, spastic paresis in the lower ex-



tremities, weakness of the bladder with cystitis, loss of the pupil reaction to light, optic atrophy, and slight girdle-like sensory anomalies on the body. Clinically there appeared to be a beginning cervical tabes with a spastic spinal paralysis. There was found pathologically a combined tract affection, which in the cervical cord involved a part of the posterior columns and the cross-pyramidal tracts, in the rest of the cord only the cross-pyramidal tracts.

Pupil anomalies also sometimes occur along with symptoms of posterior and lateral column disease.

In such cases, from our knowledge gained in autopsy findings, we may assume a primary nuclear degeneration in the oculomotor nucleus, in addition to the specific meningomyelitis causing posterior column symptoms.

Another combination is that of cross-pyramidal tract symptoms and rudimentary forms of tabes, which present the picture of primary optic atrophy, loss of the pupil reaction to light, lancinating pains, and slight bladder disturbances, also occasionally disturbances of sensation.

A man who, ten years before, had been treated for primary and secondary syphilis, came under my observation. For two years he has had a double primary optic atrophy, at the same time lancinating pains in the feet, and a slight disturbance of the bladder. The examination showed, in addition to the optic atrophy, which was tabetic in form, increase in the tendon-reflexes, and slight spastic paresis of the lower extremities. There was no ataxia, no sensory disturbances and no Romberg. The pupils were unequal in size and reacted slowly to light.

After five years an examination of this patient revealed that the optic atrophy had become complete, the spastic condition of the lower extremities remained unchanged, and no new symptoms had appeared. Cases of the above type are not infrequent.

**Spinal Roots.**—There still remain a few words to be said concerning the symptoms caused by the spinal roots.

The meningeal symptoms are essentially root symptoms, the hyperæsthesia of the back, the girdle-like pains, the neuralgic sensations radiating into the extremities, are

caused by irritation of the posterior sensory roots, and these are irritated in turn by the thickened and inflamed cord-membranes through which they must pass. The symptoms of irritation on the part of the anterior motor roots consist in twitching, fine tremor, and in atrophic paresis and paralysis.

Clinically it is impossible to differentiate whether these root symptoms are caused by a root neuritis which is independent of the meningitis, or by the meningitis and its consequent effect upon the roots.

### XIII

#### TABES AND SYPHILIS

THE tabes-syphilis discussion, over which volumes have been written, is at an end. The discovery of pleocytosis, albumen and globulin and the Wassermann reaction in the spinal fluid of tabetics and finally Noguchi's finding of the *Spirochæta pallida* in a tabetic spinal cord furnished the last link in the chain of evidence needed to positively prove the syphilogenetic origin of tabes. In the chapter on paresis I have already said that the question was still undecided as to the rôle which the parasites of syphilis play in the causation of paresis and tabes. I wish to repeat that without the assumption of a poison produced by the spirochætes the pathology of tabes is difficult to explain. Strümpell's toxin theory, with some modifications, still has a place for consideration. This modification consists in not regarding tabes as due to the influence of the toxin of a former syphilis which has long ago ceased to exist, but that in every tabetic there still exists in the central nervous system active living spirochætes which generate this toxin, slowly or quickly, continuously or only at intervals, and in varying degrees of intensity.

Although one conception of the disease has been greatly changed, much of our previous knowledge concerning it is still pertinent.

**Historical.**—Since Fournier, in 1875, asserted that tabes was the result of syphilis, two opinions, one which affirms, and the other which denies, have been sharply contrasted.

In France Vulpian and Grasset soon accepted Fournier's view, while Charcot, on the other hand, combated it to the last. In England Gowers was one of the first to become a supporter of the Fournier teaching. In Germany Erb early became the most ardent advocate of this doctrine. At the head of the opponents in Germany stand C. Westphal and Leyden.

**Conjugal Tabes.**—Concerning the frequency of conjugal tabes the statistics of Mönkemöller and Heubner may be consulted. Mönkemöller in 741 cases of paresis found 18 conjugal cases. Heubner in 40 cases of paresis and tabes in married women found 14 conjugal cases.

The following tables are taken from my own experience in hospital and private practice.

In the seven years, from 1901 to 1907, there were 200 cases of paresis admitted to my department at Eppendorf, of which number 156 were men and 44 women. In these 200 cases it was possible in 74 to examine both husband and wife. During this same period 103 cases of tabes were also admitted, of which number 66 were men and 37 women. In these 103 cases both the husband and wife were examined in 76.

TABLE I

Paresis.		Tabes.	
Men.....	156	Men.....	66
Women.....	44	Women.....	37
200 (74)		103 (76)	
303 (150)			

In the 74 cases of paresis in which both husband and wife were examined undoubted conjugal paresis was found in 6 cases and suspicious symptoms in 7 cases.

It was a surprising fact in the cases in which the wife was brought in with paresis and then the husband was later examined that the conjugal disease was much oftener encountered than when the husband was the primary patient. Exactly the same situation was also found to be true with reference to tabes.

TABLE II

Primary.	Conjugal.	Suspicious.	Primary.	Conjugal.	Suspicious.
Husband.....56	1	6	Males.....45	9	—
Wife.....18	5	1	Females.....31	12	2
74	6	7	76	21	2

Cases of paresis and tabes with primary disease of the husband. 101. Conjugal 10  
Cases of paresis and tabes with primary disease of wife. .... 39. Conjugal 17

Total number of cases of paresis and tabes in man and wife. 150. Conjugal 27



The only explanation for this remarkable relationship of both tabes and paresis in the rare occurrence of either tabes or paresis in married women whose husbands have primarily one or the other of these diseases lies in the fact that the husband who contracted his infection earlier in life, before his marriage, usually has passed by the stage where he is able to transmit the infection.

The occurrence of tabes and paresis and other syphilitic organic nervous diseases in families has been discussed in a former chapter.

**The Late Development of Tabes.**—In those cases in which tabes appeared unusually late in life the syphilis was contracted unusually late. Numerous cases of this nature have been reported.

In a case which came under my observation the patient acquired his syphilis in his fifty-sixth year, and in his sixtieth year presented the symptoms of primary optic atrophy, lightning pains, Argyll-Robertson pupils, loss of the patellar reflexes, and hypalgesia—in short, the picture of a classical tabes.

In a second case the patient was sixty-six years old, and had been infected with syphilis when he was sixty. He began in his sixty-fourth year with a primary optic atrophy, and at his examination, two years later, I was able to demonstrate Argyll-Robertson pupils, Romberg's symptom, loss of the patellar reflexes, and characteristic sensory disturbances on the back and lower extremities.

**The Frequency of Sterility in Tabetics.**—Mendel in 252 married women with tabes who were examined by him found that 32.9 per cent. were childless.

The absence of offspring depends either upon the fact that conception has not occurred, or that the child died soon after birth, usually within the first month, or that abortion occurred. The percentage of childless marriages in general has been estimated at from 10 to 15 per cent., so that it will be seen that childlessness in tabetic women is almost three times as frequent as in non-tabetic, living under the same social conditions.

The occurrence of tabes and arteriosclerotic aneurism

of the aorta together has been frequently observed at comparatively an early age. I have observed six cases of this character, and in all of them except one lues could be demonstrated.

Concerning the frequency of tabes and disease of the heart and aorta, Strümpell has recently directed our attention. His deductions were as follows:

(a) In patients with insufficiency of the aortic valves, sclerosis of the aorta, and aortic aneurism one finds not infrequently, when carefully sought for, signs of tabetic disease.

(b) Well-marked tabes is often found in combination with aortic insufficiency and aortic sclerosis.

(c) This combination of both diseases is simply the consequence of a previous syphilis.

**Tabes in Hereditary Lues.**—Tabes occurs in children with hereditary lues and also in adults as a later expression of hereditary syphilis, just as the infantile or juvenile paresis develops after hereditary syphilis.

Tabes in children naturally has a particular value in the determining of the etiology of the disease, since the other causative factors, as trauma, alcoholism, psychic trauma, overexertion, and sexual excesses may be eliminated.

In five-sixths of these cases syphilis can be definitely proven (Marburg). In striking contrast to tabes in adults after acquired lues the disease is equally distributed between the sexes, which may be explained by the fact that hereditary syphilis of course does not favor either sex, while in acquired syphilis men are more often affected than women.

The occurrence of tabes and paresis is not so rare. In my own experience I have found tabetic children in ten different families. In all these cases there was a history of syphilis in the family, in nine cases either the father or mother or both, in one case the child was infected extragenitally. I do not know of a single case of infantile or juvenile paresis or tabes without syphilis.

**Tabes and Syphilitic Disease in the Same Family.**—I have observed a number of times that members of the same

family (brother and sister) who had become infected with syphilis developed disease of the central nervous system. In one instance two brothers, the one several years after his infection developed paresis, the other tabes. In two other families both brothers in each family became tabetic. In another family one brother was affected with syphilitic meningomyelitis, as the autopsy proved, and the other with a typical tabes. In still another family one brother was tabetic and the other was affected with Erb's syphilitic spinal paralysis.

The cases which Erb presented to the International Congress at Moscow are very pertinent here. One case concerned three brothers who had suffered a psychic trauma, two who had never had syphilis developed neurasthenia, while the third brother, who was a syphilitic, became affected with tabes. In another case a man who had been a syphilitic instead of having regular sexual intercourse with his wife practised onanistic manipulations; the wife developed hysteria, the man tabes.

**Combination of Tabes with Syphilitic Disease of the Nervous System and Internal Organs.**—The supporters of the Fournier-Erb doctrine admit that the pathology of tabes is different from that of syphilis, and that also the disease of the vessels in tabes is not a luetic one. In short, the pathology in cases of tabes with a history or other evidence of syphilis does not differ in any way from the cases in which the history or other evidence of lues is entirely lacking.

Adrian has made a comprehensive and thorough study of the occurrence of visible syphilis and tabes at the same time. He has divided his cases into three groups:

1. Cases with pathological findings of tabes with also active evidences of syphilis in the central nervous system. He reports 16 cases in this group, to which I am able to add 4 more (3 cases of brain gummata and 1 case of specific meningitis along with beginning tabes).

2. Pathological findings of active syphilis in other organs outside of the central nervous system, and evidences of tabes in the nervous system. Adrian reports 15 cases here, to which I can add 7.

3. Cases of tabes in which active manifestations of syphilis have been observed during life in conjunction with tabes are by far the largest group. Adrian reports in this group 65 cases.

As a result of his study of these groups Adrian comes to the following conclusions, which I believe to be correct:

1. That the syphilitic virus, although latent, in combination with well-marked tabes may exist for years in the system.

2. A combination of the visible manifestations of syphilis on the skin or in the internal organs and a typical tabes is not so rare as it was formerly supposed to be.

A careful examination of patients with tertiary syphilis for evidence of tabes should always be made.

3. The coexistence of active syphilitic changes in the various internal organs and tabes compels us to the assumption of a close relationship between the two diseases.

**A Combination of Specific Spinal Meningitis and Tabes.**—The question as to whether the tabetic changes in the posterior columns of the cord are the result of the spinal meningitis in the cases reported has been carefully considered, and the conclusion arrived at that the tabes was entirely independent of the meningitis. The observers came to this conclusion because the meningeal changes at the different cord levels did not correspond to the degenerations of the posterior columns, and because also, while the anterior roots were surrounded equally with the posterior roots with meningeal proliferations, the anterior roots were not degenerated.

**Strümpell's Toxin Theory.**—The present standpoint of the majority of the supporters of the tabes-syphilis doctrine is the one which Strümpell first proposed. Strümpell propounded the theory that syphilis produces a toxin which has an injurious effect upon the ganglion-cells and nerve-fibres of the nervous system. The action of this toxin does not refer to the direct consequences of syphilis which produces characteristic pathological changes, but only to an indirect or secondary action which one can imagine as due to the discharge of a chemical poison. Strümpell calls atten-



tion to the severe clinical nervous disturbances following diphtheria in exemplifying his theory, the relation of which to the toxin of diphtheria no one doubts. The opponents of the Fournier-Erb teaching on the other hand say that this theory is purely an arbitrary one, and that nothing is known of a toxin of syphilis.

Without the assumption of a toxin effect, however, some cases would be difficult to explain; for instance disease of the spinal cord in severe anæmias and carcinoma. In accepting Strümpell's theory one must of course admit a selective action on the sensory portion of the cord by the syphilitic toxin. This ought not to be difficult because we have been aware for many years of the selective action of poisons on the nervous system. We know for example that lead has a predilection for the motor and ergot for the sensory tracts, and that the toxin which is produced in pernicious anæmia injures chiefly the posterior columns.

**Marie's Theory.**—In 1903 Pierre Marie together with Guilain presented the view pathologically of tabes that it was a syphilis of the meninges. According to their conception it was the posterior part of the pia alone which underwent inflammatory changes. The pathological process of tabes consists in a lesion of the posterior roots, and a posterior meningitis which pathologically possesses all the ear-marks of a specific meningitis. According to Marie there exists in the pia mater a lymph system. The cell elements which are found in the spinal fluid of tabetics are lymph-cells. Histology teaches us that the lymph-system of the posterior part of the pia mater scarcely communicates, or communicates not at all, with the lymph system of the anterolateral portion of the pia.

The pathology of the posterior part of the pia is a separate pathology in itself. The tabetic process consists in a lesion of the entire posterior lymph system of the cord. According to Marie's theory then tabes is a syphilitic disease of this lymph system. According to the consensus of opinion of the majority of the authorities on this subject simplicity is about the only recommendation that can be made for Marie's theory.

The value of the almost constant appearance of excess globulin and lymphocytosis, as well as the Wassermann reaction in the spinal fluid in both tabes and paresis, as an argument in favor of their syphilogenetic origin, will be discussed in a special chapter.

**The Antispecific Therapy as an Argument is Useless.—**The argument against the specific origin of tabes and paresis because antispecific treatment has no influence on these diseases will not bear the light of reason. Diphtheritic paralysis is also uninfluenced by the administration of antidiphtheritic serum. The cirrhosis of the liver produced by the chronic use of alcohol remains incurable even when the use of alcohol has been stopped. The neuritis produced by malaria is in no way influenced by quinine. My position in the treatment of tabes with mercury will be made clear in the chapter on therapy. It is sufficient to say here that I have never seen a case of tabes cured or a fully developed case even materially improved by mercurial treatment. It is another question, however, to say whether in the beginning of the disease mercury, if administered in an intelligent manner, may not exert a restricting and retarding influence on its course. Dinkler's experience in Erb's clinic, and Erb's own statements, cause one at any rate to reflect seriously on this question. My own observations in this regard have shown a long series of cases of tabes incompleta, or tabes imperfecta, abortiva, rudimentary, or whatever nomenclature one chooses to adopt for such cases, all with a history of syphilis in the anamnesis, which were treated for a number of years in succession with mercury and tonic measures and remained in their rudimentary and imperfectly developed condition.

**The Infrequency of Tabes in Prostitutes.—**The infrequency of tabes in prostitutes as another argument for the opponents of the syphilis-tabes theory is that prostitutes very often contract syphilis but seldom develop tabes. The argument appears less convincing when one considers that many prostitutes die young, of either pulmonary tuberculosis or alcoholism, and that many more give up their occupation at an age when tabes is most likely to appear,

and if later they become tabetic are apt to remain silent regarding their former life. The statistics of Krön, who found 14 per cent. of prostitutes who were in the tabes-developing age to be tabetic, are a large percentage. Heubner found in 179 prostitutes 9.9 per cent. tabetic. The same observer also found among prostitutes dying in institutions that 58.5 per cent. died of paresis, 5 per cent. of tabes, and 24 per cent. of cerebrospinal lues. Jadassohn has stated that according to his experience tabes among prostitutes is of frequent occurrence, and Kraepelin says that paresis is remarkably common in young women who are prostitutes.

**The Disproportion Between the Frequency of Syphilis and the Infrequency of Tabes in Different Countries.**—The statistics on this subject have again proven themselves to be unreliable. One set of observers produce statistics showing that syphilis is wide-spread in such countries as central Asia, India, Japan, Abyssinia, Turkey, and among the colored population in the various countries where they are found, while tabes is exceedingly rare. Another set of observers on the other hand prove by statistics exactly the reverse to be true. For instance, Jeanselme has stated that in Indo-China syphilis is exceedingly wide-spread and also that gummatous diseases of the brain and spinal cord occur not infrequently, while on the other hand parasyphilitic affections are entirely unknown.

Halban on the contrary finds that tabes in Abyssinia is six times as frequent as it is in Vienna; Collins, of New York, finds only one-fourth as many cases of tabes there proportionately as Holzinger finds in Abyssinia, and Hecht reports tabes as by no means uncommon in the American negro.

It is interesting to note that while Glück from his experiences became an opponent of the syphilis-tabes theory, Hödlmoser, who worked in the same city (Sarajewo, Bosnia) and indeed in the same hospital, was an ardent supporter of it. Both Dühring and Glück have called attention to the fact that in their material not only tabes but also all specific nervous diseases were exceedingly rare. Dühring states according to his experience, in general, this is

due to the nature of the syphilis, and, in comparison to the lesions of the mucous membrane and skin, the nervous system is very seldom affected. In other words, the lues found in Turkey, Bosnia, and Asia Minor with reference to its action on the nervous system possesses an entirely different influence from the ordinary syphilis occurring in Europe.

In this connection the well-known fact will become better understood, that in patients with tertiary lesions on the skin, mucous membranes and bones, tabes is rarely found, as well as the fact that tabes is especially frequent after the milder attacks of lues which Fournier describes, and for this reason is the more dangerous. A further explanation may lie in the fact that in Turkey, Bosnia, and Asia Minor on account of the Mohammedan population alcoholism is lacking. In these countries also, as well as for the most part in other countries where tabes is actually rare, civilization is upon a low level. Finally, as Strümpell has pointed out, we know of no country where tabes is of frequent occurrence and there is either no syphilis or very little syphilis.

**Edinger's Exhaustion Theory.**—Edinger produced in an experimental way several years ago posterior column degenerations. He found in rats which he caused to work to the point of severe muscular fatigue, along with traces of changes in different parts of the spinal cord, changes in the posterior roots and tracts which resembled those found in the posterior column degenerations in humans.

He also found when these rats had been made artificially anæmic that after only a moderate degree of muscular fatigue these degenerations appeared. Edinger applied the knowledge gained in these experiments to formulating an explanation for the cause of tabes. He said in a system weakened by lues the posterior columns became diseased through hyperfunction because the supply of nerve-substance in comparison with its consumption, on account of hyperfunction, was insufficient. He assumed that the sensory columns became affected for the reason that the sensory neuron is less resistant than the motor.



It is questionable if the results of these experiments on animals should be applied to human pathology. On the other hand, it is certain that those who are not subjected to severe physical labor develop tabes just as often as, if not oftener than, those who are.

It may further be mentioned that the artificially produced degenerations of Edinger are acute in character, while the posterior sensory degenerations of tabes are chronic.

Krön in 134 female patients who were machine workers, and had been for years, who furnished the foot-power to operate their own machines, found syphilis in 56 per cent., but not a single case of tabes.

**Atypical Types of Tabes.**—Those who see many cases of tabes often observe cases in which they are not absolutely sure of the diagnosis. In such cases it is doubtful whether they should be classified as abortive cases of tabes, rudimentary cases, as Erb calls them, or cases of spinal-cord syphilis which have recovered. Such cases acquire through their long course or state of remission their characteristic stamp, and for this reason are only of value to the observer when they have been under control for years.

**Lightning Pains as an Isolated Symptom.**—A number of years ago Erb directed our attention to these cases. In the first place there are the cases which have suffered pains in the lower extremities for years, that were extraordinarily severe, of the character of lightning pains coming on in attacks, and susceptible to changes of weather.

A gentleman whom I have had the opportunity of observing for the past fourteen years belongs in this category. I have examined him several times every year, but have never been able to demonstrate the slightest anomaly of the nervous system. Twenty-one years ago he acquired syphilis and has had thorough and repeated treatment. These attacks of lightning pains have remained from the beginning the only discoverable symptom.

In another case where the infection of syphilis dated back twenty-four years the patient suffered severe attacks of lightning pains, coming on every two or three months

for a period of about eight years. Then there appeared rather acutely in the course of two or three months the picture of spinal ataxia, the patellar reflexes disappeared, pupil symptoms developed and in the period of about one year the case presented the usual picture of a well-advanced tabes.

Such cases teach us that with characteristic subjective symptoms and negative objective findings, even though the subjective symptoms have continued for many years, one should be guarded in the prognosis.

**Absence of the Patellar Reflexes.**—More frequent than these rather rare cases of lightning pains are those cases in which the absence of patellar reflexes and pupil anomalies show a diseased process in the central nervous system.

It is possible but not absolutely certain that those cases in which the objective symptoms manifest themselves by the absence of the patellar reflexes, as well as slowness in the response of the pupil reaction to light and anisocoria or myosis, are cases of tabes which have come to a state of stand-still or quiescence. It is, however, just as possible that local meningitic or meningomyelitic processes which have healed with scar formation constitute the pathological foundation for these clinical symptoms.

**Isolated Pupil Anomalies.**—It has already been stated that anomalies of the pupil in size and reaction in syphilitics are often found and also often remain permanently as isolated symptoms. The majority of these cases, although not all, present a lymphocytosis and increase of the globulin in the spinal fluid. As has been pointed out in regard to paralysis of the oculomotor nerve, so also it happens in isolated loss of the pupil reaction that this occurs in non-syphilitics and then without pleocytosis. Some of these cases complain of no subjective symptoms whatever and some suffer attacks now and then of lightning pains, but otherwise appear to be entirely normal. One of these cases which I have known for ten years is interesting because of the fact that while he was affected in this manner he married and infected his wife soon after the marriage. The wife now has a typical tabes.

Finally there are those cases which one cannot with certainty classify as tabes, in which the pupils and patellar reflexes behave as in ordinary tabes, in which, moreover, irregular sensory disturbances and an abnormal frequency to urination with dysuria exist. In these cases an energetic antispecific therapy causes a disappearance of all the symptoms except the pupil and patellar reflex disturbances, so that the patients are free from any subjective discomfort and are not ataxic.

**Isolated Gastric Crises.**—It is known and has recently been called particularly to our attention, by Dunger, that gastric crises may be an early symptom of tabes. If in such cases pupil anomalies or absence of the Achilles or patellar reflexes are found the diagnosis of tabes cannot be doubted.

The diagnosis is difficult, however, in those cases in which in former syphilitics gastric crises appear at longer or shorter intervals without the appearance of a single objective symptom on the part of the nervous system. Every experienced physician knows that many cases of typical gastric crises, both with and without hyperacidity, occur in patients who have never had syphilis and whose nervous system is objectively sound. In such cases stomach neuroses must be ascribed as the cause and a differential diagnosis is rendered still more difficult. Under such conditions the examination of the spinal fluid and the absence or presence of Phase 1, the test for globulin, and a determination of the number of lymphocytes will furnish the best means of differentiation.

**Pseudotabes Syphilitica.**—The discussion over the classification of the pathological changes found in the posterior columns in tabes has been an extensive one. Some observers, as Charcot, believe this degeneration is caused by a chronic parenchymatous inflammation of the posterior columns; others, as Frommann and Friedrich, by a chronic interstitial inflammation (sclerosis), while others, as Erb, think that both forms of degeneration are present.

According to the researches of Schröder and the findings of Stargardt in the degenerated optic nerves of tabetics, the opinion seems to prevail that as in paresis so in tabes,

we have to deal with two kinds of pathological processes, the primary degenerative and the inflammatory, which exist side by side.

Cases of syphilitic disease of the cord simulating tabes were first recognized by Oppenheim and Eisenlohr. In these cases the patients had formerly had syphilis and presented a number of tabetic symptoms which under anti-specific therapy either disappeared or were much improved. In some of these cases from the beginning there were symptoms which did not fit the diagnosis of tabes, in others these symptoms appeared later and made possible the correct diagnosis.

The pathology in these cases showed that instead of a



Fig. 92.



Fig. 93.

FIGS. 92 AND 93.—Case of Eisenlohr's.

primary tabetic degeneration of the posterior columns, the process was a secondary one and was caused by a specific meningitis which either ensnared the posterior roots or destroyed large transverse areas of the cord, and thus produced secondary degenerations in the roots and cord.

Eisenlohr in 1888 reported two cases which clinically presented almost typical symptoms of tabes with an undoubted history of syphilis, and at the autopsy did not show the systematic degeneration of tabes but disease of the posterior columns as the result of a specific meningitis. In one of these cases the involvement of the posterior columns affected the root-zone in a segment of the cord, in the other the entire area of the posterior columns was involved, but this involvement was limited to a few segments only.

Numerous cases of this nature have since been reported, so that in all cases in which the clinical course deviates



somewhat from a typical tabes, or in addition to symptoms of a classical tabes cerebral or spinal symptoms appear which do not arise from disease of the posterior columns, it becomes our duty to ascertain whether or not the case is one of cerebrospinal or spinal syphilis which simulates a tabes. In all such cases one should administer without hesitation antispecific treatment.

A rapid development of the degeneration in the posterior columns, a change in the intensity of individual symptoms, a change in the behavior of the patellar reflexes, a complication of paresis or paralysis of the extremities, in which one extremity is more affected than the other, speaks in favor of a pseudotabes.

The affection of the optic nerve is also one of neuritis instead of primary atrophy, and the pupils more often show a complete loss of their reflexes rather than that of the light reflex alone.

**Differential Diagnosis of Spinal Syphilis. History.**—The diagnosis of syphilis of the spinal cord can by no means always be made with certainty. One should consider the probability of spinal syphilis in every case of disease of the cord, whether acute or chronic in character.

At the beginning of the discussion of this subject, it may be stated that there is no single clinical symptom which in itself is pathognomonic of luetic disease and which some other non-specific affection cannot cause.

The positive history of a specific infection in the anamnesis is naturally important in the diagnosis.

**Other Symptoms of Syphilis.**—The discovery of other specific symptoms elsewhere on the body in a patient with spinal-cord disease, which, however, is not often, is also important.

In the differential diagnosis between tuberculosis and syphilis one should remember that not infrequently there exists in the same person a combination of both diseases.

**The Intensity of Individual Symptoms No Criterion to Judge of Local Involvement.**—Sachs was one of the first to call attention to the disproportion between the intensity of individual symptoms, and the extent of local involvement.

**The Brown-Sequard Symptom-complex.**—Concerning the frequency of the Brown-Sequard complete or incomplete hemiparesis where trauma or a non-specific tumor can be excluded this symptom may be regarded of great value in the diagnosis of spinal syphilis.

**Brain Involvement.**—Involvement of the brain is a very frequent complication. Multiple sclerosis also affects both the brain and spinal cord at the same time and by no means always in the classical form with nystagmus and scanning speech. Malignant tumors likewise may involve simultaneously both the brain and cord.

**Irritative Symptoms.**—The irritative symptoms which appear quite often in the prodromal stage of spinal syphilis can occasionally be utilized in the diagnosis, but only when later symptoms follow. They are not characteristic alone.

**Transient Character of Symptoms.**—Oppenheim and Siemerling have emphasized the fluctuating character of the symptoms, especially with regard to the patellar reflexes. There has been observed, however, in both extra- and intramedullary tumors, tubercular compression myelitis, and also chronic anæmias, changes in the behavior of the patellar reflexes. A fluctuation in the reaction of the pupils occurs likewise in brain-tumors.

**Influence of Therapy.**—If under the administration of mercury and iodid the symptoms disappear we may conclude in most instances that the affection was of a luetic nature, provided that the symptoms were not such as were capable of spontaneous recovery. There are specific gummatous processes which very often prove to be refractory to treatment, and one must consider that scar tissue in the spinal cord, which pathologically represents a recovery, may produce the same disturbance of function as an unhealed luetic process.

**Spinal Neurasthenia.**—In some cases in the prodromal stage of spinal syphilis differential diagnostic difficulties between spinal neurasthenia and spinal syphilis may present themselves. Neurasthenics complain about pains in the back, stiffness of the back, and tenderness to both pressure and percussion. There is also often a sensation

of paræsthesias and heaviness in the limbs and a tendency to become exhausted easily.

If a history of syphilis is present in the anamnesis of the patient, often the further course of the disease must be awaited in order to make a definite decision.

Here again the spinal fluid examination and the absence or presence of Phase 1 (globulin test) and the Wassermann reaction, according to Hauptmann's method, should be regarded of great value in deciding the diagnosis.

**Compression Myelitis from Tubercular Caries.**—One may only be permitted to assume a tubercular compression myelitis when disease of the vertebral column can be demonstrated, although we know such disease may exist in a latent form for a long time when the patient has tuberculosis elsewhere. When a specific infection has existed in a patient with a tubercular inheritance and demonstrable tubercular disease it may require a long period of observation to determine the correct diagnosis.

A man thirty-six years old was admitted to the Eppendorf Hospital with tuberculosis of the bones in the left hand. After the bone tuberculosis had healed he was transferred to another department because of a nephritis. Two years before this he had contracted syphilis. He then developed the clinical picture of a chronic dorsal myelitis. Under inunctions considerable improvement in the spastic symptoms occurred. The patient, however, died of chronic albuminuria and a secondary cachexia. There had been no evidence of a tuberculosis of the internal organs.

At the autopsy a tubercular caries of the upper dorsal vertebræ with a tubercular peripachymeningitis in the lower cervical and upper dorsal regions was found. There was also amyloid degeneration of the kidneys, but no evidence of tuberculosis of the internal organs. As evidence of the past syphilis there was a double interstitial orchitis.

In such cases in the spinal fluid both the globulin and lymphocytes may show a considerable increase.

**Spinal-cord Tumors.**—They may also present diagnostic difficulties, as the following case illustrates:

A patient in my department at Eppendorf had a spastic

paraplegia with a slight disturbance of the bladder, hypo-æsthesia of the lower extremities and lower half of the abdomen, and rigidity and sensitiveness of the vertebral column. These symptoms began four years after a syphilitic infection. Antispecific treatment caused no improvement. The radiating girdle-pains were very severe. Decubitus developed. The patient committed suicide before we had the opportunity to make an exploratory laminectomy.

Postmortem revealed a fibroma the size of a walnut on the dura between the seventh and ninth dorsal segments.

We know at the present time that tumors of the spinal membranes are not so rare and it becomes our duty in differential diagnosis to give them careful consideration. In those cases where multiple neurofibromata are found under the skin the task is not so difficult. A number of cases of this kind have been reported.

It is worthy of mention and evidently not well known that in multiple neurofibromatosis the nerve-roots are often extensively affected.

The examinations of the spinal fluid in compressing spinal-cord tumors up to the present time indicate that lymphocytosis can occur and also that a sort of *typus inversus* may often be present, a very strong globulin reaction without any increase of lymphocytes.

**Multiple Sclerosis.**—The differentiation of a chronic syphilitic myelitis from a multiple sclerosis is often extremely difficult. There is probably no differential diagnostic question in the sphere of syphilis of the nervous system which occurs so frequently. Both affections may have the same beginning with motor weakness and spastic symptoms in the lower extremities, transient paralyses of the eye muscles, and temporary disturbances with the bladder. Both may exhibit intercurrent improvements, both attack by preference patients during the first half of their life, and both may show remissions after antispecific treatment, the one *post hoc* and the other *propter hoc*. In many cases the determining symptoms, such as a characteristic nystagmus, optic atrophy, well-marked intentional tremor, a shaking head or body, sooner or later will clarify the situation.



Oppenheim was one of the first to point out that the atypical form of pure spinal multiple sclerosis is not so rare an affection.

Case of spinal multiple sclerosis:

A woman, thirty-nine years old, married five years, marriage sterile, ten years before contracted a lip-chancere. The initial lesion and several attacks of secondary symptoms were thoroughly treated with antisyphilitic treatment. Since that time the patient had observed no further manifestations of syphilis. The present affection, which had existed eighteen months, began with paræsthesias and motor weakness in the lower extremities. Gradually a spastic paralysis developed, which not only rendered standing and walking but also the movements of her limbs in bed impossible. The upper extremities became slightly paretic and inside of one year developed into a state of marked contracture. Disturbances of sensation appeared in the form of hypoæsthesia for touch, temperature, and pain. The bladder was paretic. All the cranial nerves, including the optic and the nerves controlling the pupils, remained entirely normal. Four years after the beginning of the disease the patient died of severe decubitus. The autopsy showed an advanced stage of multiple sclerosis of the spinal cord. There were no evidences of syphilis either in the cord or internal organs.

The Brown-Sequard symptom-complex can in rare cases occur transiently in multiple sclerosis.

The differential diagnosis has been made especially difficult between these two diseases by two recently established clinical facts. First, because of sclerotic disease of the posterior roots, which Dinkler and Nonne have shown may occur in multiple sclerosis, severe radiating pains may appear in the course of the affection. Second, psychic disturbances in the form of confusion, maniacal excitement, enfeebled grandiose ideas, mental conditions which have long been recognized as occurring in brain syphilis, may also occur in multiple sclerosis.

Pleocytosis and the globulin reaction are not infrequently present in the spinal fluid of patients with multiple

sclerosis. The Wassermann reaction in the spinal fluid according to Hauptmann's method at the present time is undoubtedly the best means of differentiation between these two affections.

**Combined Tract Disease.**—The differentiation between combined tract disease and pseudosystem disease lies in the fact that the development and sequence of the symptoms in the latter is different from those in the pure forms of a combined tract affection. In the latter the symptoms appear slowly and gradually, belonging at first chiefly to one system, then later other symptoms appearing which show that another system has been affected. The symptoms are then either chronically progressive or the quiescence period is only temporary. An actual retrogression does not occur.

On the other hand in pseudosystem disease symptoms appear irregularly belonging to one system or another, the regularity in progression is absent, marked improvements in the clinical course, and a partial or complete disappearance of individual symptoms are often observed. This is especially true in disease of the posterior and lateral columns due to anæmic processes. The symptoms of the disease here sometimes entirely disappear.

**Hysteria.**—Hysteria does not play as important a part in spinal as it does in cerebral syphilis. Nevertheless now and then cases occur in which for a long time, because of the capriciousness and spasmodic character of the symptoms, the changes in the intensity of the subjective complaints, and the apparent influence of suggestive methods, a hysterical basis for the disease may be assumed. This becomes more easily understood when we remember that objective somatic symptoms may be absent in the beginning of organic disease.

Hysteria may occur also in combination with lues of the nervous system as it does with brain-tumors and multiple sclerosis.

**Prognosis of Spinal Syphilis.**—The opinions of different authorities vary as to the prognosis of spinal syphilis.

**General.**—Gebhardt says that the earlier, more energetic, and longer continued the treatment, the sooner a recovery

can be attained, and if one is able to make a diagnosis early the majority of the cases will get well. Williamson regards the prognosis of spinal as better than that of cerebrospinal syphilis, while Oppenheim holds the opposite view. It is readily understood that an advanced age, existing disease in other organs, other intoxications, among which alcohol may be placed first, or any other cachetic condition render the prognosis worse. This is true in all forms of syphilis of the nervous system.

As was stated in the chapter on "Syphilis and the Spinal Cord," the most frequent form of spinal lues, meningitis and meningomyelitis in a relatively small transverse area of the cord will produce more severe disturbances of function than upon the large area of the surface of the brain.

The same thing is true in disease of the vessels caused either directly or indirectly by syphilis. An obliterating endarteritis in the cord will cause naturally a greater disturbance of function than in the brain. In general one can say that in the cord compensatory substitution will always be much less than in the larger brain-mass.

**Prognosis Depends Upon the Form of Spinal Disease.**—The prognosis also varies with the form of spinal syphilis. The small-celled infiltration of the meninges as well as the gummatous infiltrations into the membranes and cord are the most capable of regression. If the clinical picture exhibited is due to an acute transverse myelitis or a chronic myelitic paralysis of this type the outlook for recovery is by no means poor. The recovery may be a complete one or a recovery with a paretic weakness of the extremities and reflex anomalies due to the formation of scar tissue at the spot where the specific tissue had previously formed, or the process may come to a state of quiescence until after a longer or shorter period it lights up again in the same place or in another part of the nervous system.

In transverse disease a lesion in the dorsal cord is more favorable than one in the lumbar and sacral cord because of the paralysis of the bladder and rectum when situated in the latter and the dangers of decubitus. An involvement of the medulla is especially dangerous.

The syphilitic spinal paralysis of Erb because of its relatively more benign nature occupies a special position in the prognosis, since the pure forms of this affection frequently regress to a certain extent and come to a halt.

If the acute and chronic myelitis depends upon a necrosis of the nerve-substance, due to a shutting off of the blood supply, improvement is out of the question. In these cases cystitis and decubitus with their consequences are the cause of death.

With the exception of the "syphilitic spinal paralysis" the prognosis in the specific system affections is not good because these forms are progressive in nature and are uninfluenced by treatment. They are not the direct cause of death but shorten the life because the patient becomes weakened in his natural resistance.

**Prognosis Not Influenced by Previous Treatment.**—The curable forms of meningitis and meningomyelitis show a better prognosis, the sooner treatment is administered and the more intelligently and energetically it is carried out. As is true in syphilis of the brain so it is also true in syphilis of the spinal cord, the prognosis does not appear to be influenced by previous antispecific therapy during the initial and secondary stages of the disease. The prognosis seems to be equally as good in those cases which never received any earlier treatment as in those which were thoroughly treated. When the nervous system has become affected the influence of the therapy depends chiefly upon the form of the syphilitic disease.

Syphilitic symptoms appearing soon after the infection usually have a better prognosis than those which appear a long time afterwards, but even then there are exceptions.

**Relapses.**—When a spinal paralysis has entirely disappeared the patient is by no means to be regarded as free from danger. The possibility of a relapse is always threatening.

The spinal fluid reactions make us perhaps safer in our prognosis in so far as relapses are concerned. I have seen not a few cases of spinal cord syphilis, which were apparently cured but the spinal fluid reactions still remained,



that later relapsed. On the other hand, I have seen a number of cases in which along with a clinical recovery the spinal fluid reactions disappeared. In none of these cases has a relapse as yet occurred. In so far as our present experience goes, we may express the prognosis as "good" when the spinal fluid reaction, along with the clinical symptoms, disappear, and "doubtful" when they remain.

The old expression "Syphilis does not die, it only sleeps" often renders disappointing our apparently most satisfactory therapeutic results.

## XIV

### CEREBROSPINAL FORM OF SYPHILIS

THE cerebrospinal form of syphilis is by far more frequent than either the spinal or cerebral forms alone. This is as one would naturally expect it to be, because the pia, arachnoid, and dura of the brain and cord are continuous with one another. The veins and arteries of the cord form likewise an unbroken unit, and the nervous elements bear also, apart from the individual differences of the ganglion-cells performing different functions, the same character.

#### **Either Brain or Spinal Symptoms Frequently Predominate.—**

In many cases one speaks of brain-syphilis because the cerebral symptoms predominate to such an extent that the spinal symptoms are neglected; in other cases the reverse occurs. There are numerous observations in the literature where extensive syphilitic changes have occurred in both the brain and cord that have not been revealed in the clinical course. The following is a case which came under my observation. A case of meningomyelitis of the cervical and lumbar cord in the course of four months died of cystopyelitis. Repeated examination in this case did not reveal any brain symptoms. The autopsy, in addition to the meningomyelitis, showed a localized gummatous meningeal affection at the base of the pons.

A fact which experience in brain-tumors has particularly emphasized is that the pathological changes are frequently far more intense and extensive than the clinical symptoms would lead us to suppose.

**Is Involvement of the Brain More Often Latent?—**In general, a lesion of the brain is much more apt to escape notice than one in the spinal cord because of the larger and more numerous indifferent areas in the brain. A gummatous nodule in the brain, a localized meningitis, an endarteritic or endophlebitic affection, so long as no main trunks are involved, can escape notice for a long time. Frequently this

latence is only an apparent one. Apparently irrelevant discomforts, as transient attacks of headache, dizziness, mental depression, disturbance of sleep, because they pass away, are forgotten.

**Pathology.**—A glance at the pathology of cerebrospinal syphilis shows the most varied combinations. In the brain only an endarteritis with its consequences may exist, while in the spinal cord there may be a specific meningomyelitis both with and without arterial changes, and with and without gummatous infiltrations into the meninges and the substance of the cord. On the other hand, the spinal cord may present the well-known arterial and venous disease with secondary softening and sclerosis in combination with different specific changes in the brain. The disease of the brain may be a multiple and extensive one, while the involvement of the cord is limited to one form and a slight one, and *vice versa*.

Finally, specific disease may be evenly distributed in the brain and cord, as cases reported by numerous observers prove.

Cases of metasyphilitic disease, such as tabes and paresis in combination with specific gummatous affections, which not infrequently occur, are not classified here.

The two most frequent forms of cerebrospinal syphilis are Heubner's disease of the blood-vessels and the different types of meningitis.

The microscopic examination sometimes reveals the varied character of the meningeal and vessel disease when the macroscopical appearance shows only a gummatous tumor. The microscope often enables one to recognize that the diseases in the brain and spinal cord were contemporaneous or that the lesion in the brain was of an earlier date than the one in the cord.

**The Postsyphilitic Changes.**—The postsyphilitic changes which affect both brain and cord represent another large category.

The postsyphilitic arteriosclerosis, with softenings and hemorrhages which lead to ascending and descending degenerations, is the most important of these. Arterioscle-

rosis and tabes frequently occur together. A postsyphilitic arteriosclerosis, with and without processes of softening, is also found in combination with cerebral meningitis and gummatous tumors. Rumpf has reported clinically the combination of cerebral hemiplegia with tabetic disease, cerebral monoplegia beginning both with and without convulsions with tabes, the occurrence of syphilitic epilepsy with tabes, and the appearance of pupil anomalies and disease of the optic nerve with chronic and subacute specific myelitis.

Reumont has called attention to the frequency of cerebral apoplexy in combination with tabes, also the occurrence of cerebral hemiplegia and spinal paraplegia and the coexistence of tabes and symptoms of basilar meningitis.

Fournier has reported cases in which transient hemiplegias and paraplegias preceded the development of a typical tabes.

A case of cerebrospinal meningitis presenting symptoms from the base and convexity:

Patient was a boy eighteen years old. The syphilitic infection was two years old. He was admitted to the hospital because of severe headache. At the time of his admittance he was in a dazed condition, sometimes entirely awake, sometimes as in a dream, or half awake. He complained also of a pressure over the eyes. He had a double optic neuritis of the congestive character, moderate mydriasis, and slowness of the pupil reaction to light. The patellar reflexes on both sides were absent. In spite of vigorous antispecific treatment a paresis of the abducens nerves, as well as of the right trochlear, soon developed. In the meantime, however, the consciousness had become entirely clear. During the following period the behavior of the pupils to light varied. One day the left pupil would react, and a few days later the reaction to concentrated light would be lost. This variation in the reaction of the left pupil continued for a period of over two weeks, when the right pupil, whose light reaction had been lost, began to show signs of a slight reaction. Six weeks later both pupils responded promptly to both light and accommodation. A



week later, however, for two days the light reaction again was lost.

The paresis of the eye-muscles had disappeared and the patient seemed to be improving nicely. One evening, without any warning, six weeks after he came to the hospital, he was seized with an epileptic convulsion, which began in the right side of his body and then becoming general, consciousness was entirely lost. Several similar attacks occurred in the course of the next four months, either severe like the first or more abortive in character. A sensation of tingling appeared in the right side, immediately after the first attack, but gradually disappeared. At the time the patient was discharged, because he insisted, the subjective symptoms consisted in occasional headaches and attacks of dizziness. Both pupils reacted both to light and accommodation, but not promptly, and the excursion of the pupils was not of normal extent. There existed in both optic nerves a slight neuritic atrophy. The patellar reflexes were entirely absent. Other spinal symptoms could not be observed.

This case is a typical one with cortical and basilar symptoms, in which the appearance and disappearance of new symptoms was unmistakable and in which the variable course finally terminated in incomplete recovery.

Combination of multiple basilar symptoms with a meningomyelitis in which the spinal symptoms remained while the cerebral symptoms disappeared under antispecific therapy:

A woman, forty-eight years old, was infected by her husband twelve years before. The husband died from tabes. When the patient was admitted to the hospital she had a double optic neuritis and well-marked specific choroiditis. She had also ptosis on the left side and on the right an abducens and facial paralysis. In addition to severe girdle-pains, there was a spastic paraplegia inferior of the Brown-Sequard type. Sensation was more involved on the right side, motility on the left. There were also sphincter disturbances. Under treatment the cerebral symptoms in remissions slowly disappeared, also the girdle-pains, but the

myelitic symptoms remained stationary, in spite of most energetic treatment, for a period of ten years, when the patient died with symptoms of bronchitis and heart weakness.

The autopsy showed a slight chronic thickening of the pia on the base of the brain, while in the dorsal cord a sclerosis beginning at the pia and extending into the cord was found. The general shrinking in the cord indicated that the process had probably been healed for ten years.

These two cases may be regarded as classical ones of the cerebrospinal form of syphilis.

There is scarcely another disease of the central nervous system which can present so variable a course as that of tabes. There is hardly a cerebral or spinal symptom which may not be manifested by it. One must always consider the question whether or not the existing cerebrospinal symptom-complex belongs to a tabes. This question is very often difficult to answer. The course of tabes may be such an unusually variable one. There are cases of tabes in which the course is an acute one, where in the period of a few months one symptom follows another; on the other hand, there are also cases where the disease appears to be stationary for many years, and still other cases where it advances in periodical relapses. Cases have been reported in which for ten years the only objective symptom was the loss of the pupil reaction to light, and afterwards either tabes or paresis developed. In a case of my own the specific infection dated back twenty years, a well-marked spinal myosis twelve years, after which an acute—almost apoplecticiform—severe tabes developed.

For this reason the clinical syndrome of loss of the light reaction of the pupil and absence of the patellar reflexes will always cause doubt in the differential diagnosis. We know that this combination is often encountered in old syphilis and may so remain as isolated symptoms for many years, without the development of either a tabes or paresis. Sometimes the appearance of a single symptom, such as beginning primary optic atrophy, gastric or laryngeal crises, or lightning pains, will clear up the situation at once. If

these two objective symptoms have been caused by a syphilitic process, one may expect, almost without exception, soon the appearance of other symptoms. The multiplicity of symptoms is characteristic of specific disease of the central nervous system, as well as their appearance and disappearance and the variation in their intensity.

As an example of this class of cases, where one symptom follows another coming both from the brain and cord, disappearing and reappearing and varying in degree, I will cite a case reported by Oppenheim. Seven years after the infection spastic paresis of the lower extremities, with sensory disturbances of the Brown-Sequard type, paræsthesias, girdle-pains, dysuria, and psychic changes appeared. From the eyes there were diplopia, oculomotor paresis, anisocoria, slowness of the pupil reaction to light, as well as ptosis on the left side. After specific treatment a remission appeared. Then the symptoms began again in the form of headache, dizziness, vomiting, partial optic atrophy, and paresis of the left oculomotor nerve; also symptoms from the base of the brain manifested themselves in the form of dyspnoea, Cheyne-Stokes respiration, anæsthesia in the areas supplied by the fifth nerve on the one side, and a facial paralysis. There was also a paresis of the lower extremities and one upper. The autopsy revealed a gummatous meningitis of the base of the brain and of the spinal cord, a gummatous neuritis of the basilar cranial nerves (optic chiasm and oculomotor, facial abducens and vagus), an atrophy of the roots of the fifth, as well as an arteritis on the brain-base.

In practice the cases most frequently encountered are those consisting in a combination of arteriosclerosis, post-syphilitic and true syphilitic disease of the nervous system. Such cases, of course, do not properly belong in this chapter, but here is perhaps as suitable a place to consider them as elsewhere.

The following cases are illustrative of this combination.

Right endarteritic hemiplegia, incipient tabes, tertiary lues:

A widow, forty-five years old, was taken sick with a right-sided hemiplegia and slight motor aphasic disturb-

ances, which came on in an apoplectiform attack. Examination disclosed a moderate degree of arteriosclerosis in the heart and palpable arteries, also periostitic deposits on the anterior surface of the left tibia, a double myosis and loss of the pupil reaction to light, and a beginning optic atrophy. Under antispecific treatment the periostitic enlargements disappeared and the hemiparesis markedly improved. The other symptoms remained unchanged.

Endarteritic right upper monoplegia, cerebral basilar meningitis, and atypical postsyphilitic disease of the posterior columns:

A man, fifty-four years old, fifteen years after a luetic infection, developed a monoplegia after an apoplectiform attack of the right upper extremity. At the examination, in addition to the hemiplegia, there were found to be loss of light reaction in both pupils, absence of patellar reflexes on both sides, without any other tabetic symptoms. Patient also had an intense cephalalgia and diabetes incipiens.

The headache and the diabetes incipiens disappeared under antispecific therapy. The other symptoms remained unchanged.

Specific basilar gummatous meningitis, encephalomalacia, arteriosclerosis (hemiparesis sinistra, hemiparalysis dextra, hemianopsia duplex, polydipsia polyuria), autopsy:

A fifty-four-year-old man ten weeks before had received a blow on the head which rendered him unconscious. During the next few days he complained of headache and said he was unable to see as well as before. As a result of his poor eyesight, two months later he made a misstep and sprained his left ankle. Upon his admittance into the hospital examination revealed a left hemiparesis with slight exaggeration of the tendon reflexes, a partial left homonymous hemianopsia, normal eye backgrounds, and normal condition of both external and internal eye-muscles.

A slight degree of arteriosclerosis was present. He admitted for the past ten years to have been a drinker, but denied ever having had syphilis. Patient was, after observation, discharged with the diagnosis: chronic alcoholism, post-traumatic arteriosclerosis, encephalomalacia.



Three months later he was again admitted to the hospital, after his disturbance of vision had increased and occasional attacks of dizziness, with unconsciousness, had developed, accompanied at times with twitching of the left leg. The examination resulted in the same findings as three months before. The backgrounds of the eye still appeared normal. There was a striking polydipsia, the patient drinking on some days eight to ten quarts of water. He complained very much of headache and dizziness. Numerous examinations of the field of vision showed variations in extent of the left homonymous hemianopsia, also difference in the power of vision on different days.

Patient now admitted that years ago he was in St. George's Hospital for venereal disease. The records showed that he was treated there with mercurial inunctions thirty years ago for chancre and buboes for seven weeks.

The administration of antispecific therapy was now begun, but without any improvement worth mentioning.

Six months later the patient was, for the third time, received into the hospital because of the sudden diminution in his eyesight three weeks before, which had occurred without any apoplectiform symptoms whatever. The examination showed that the patient was able to see only toward the right side. The right pupil was larger than the left and both reacted slowly to light, and their excursion was limited. The ophthalmoscopic examination now revealed a well-marked partial optic atrophy. The left hemiparesis still remained unchanged. The right patellar reflex was absent. The polydipsia and polyuria were very much less. The patient was again discharged from the hospital and admitted three weeks later because of a right hemiparesis which had come on in an apoplectiform manner. He now had right hemiparesis, with motor aphasic disturbances, left hemiparesis, almost complete amaurosis, and still a moderate degree of polydipsia and polyuria.

Repeated antispecific treatment produced no change. The patient became delirious and had occasional attacks of general convulsions and dyspnoea, with tachycardia and bradycardia. Other bulbar disturbances were lacking.

After three months in the hospital patient died suddenly.

The postmortem showed severe cerebral arteriosclerosis, chronic leptomeningitis of the convexity and base, and encephalomalacia in the right temporal lobe. Examination of the brain, after it had been hardened in formaldehyde, revealed just behind the optic chiasm, on the brain-base, and starting from the pia, an infiltrating gummatous tumor involving the optic tract, a part of the right internal capsule and the left optic thalamus. In the substance of the left hemisphere, taking in the region of the optic radiations and extending into the internal capsule, was a comparatively recent area of softening, the size of a walnut.

The microscopic examination showed a high degree of simple arteriosclerosis of the vessels on the base of the brain and in the spinal cord. The tumor microscopically appeared to be a specific gumma with an exceedingly intense proliferating endarteritis of the Heubner type.

In the spinal cord, where macroscopically no change was evident, microscopically an incipient tabes existed.

This case teaches us how a combination of different causes may be responsible for disease of the nervous system. There was in the anamnesis syphilis, potus, and a severe head injury. It is interesting because of the fact that even thirty years after the infection the nervous system was affected by a specific gummatous process, also because it shows that true syphilitic processes can be entirely refractory to antispecific therapy, and further, that the assumption of non-specific disease, because of the failure of antispecific treatment, is not free from objection. It is also a good illustration of the coexistence of gummatous and specific endarteritic processes along with post-syphilitic affections and simple arteriosclerosis.

The combination of a hemiplegia and a spastic paraplegia inferior, a triplegia, is a relatively frequent form of appearance of cerebrospinal syphilis.

The two following cases are of special interest since they have been subjected to the modern methods of blood and spinal fluid examination. The prognostic value of these methods is well illustrated here.

A maid, twenty-two years old, four years ago came under my care. Severe headache caused her to seek medical aid. Objectively there was a diffuse tenderness to pressure over her head and a mild double-sided neuritis optica; eight days after her admission to the hospital she broke out with a roseola syphilitica, also mucous patches on both tonsils and the labia majora. Wassermann in the blood was + + +, in spinal fluid (before Hauptmann's Auswertungs method) negative. There was marked lymphocytosis and Phase I.

Under an energetic mercurial course, these symptoms disappeared.

One-half year later she presented herself again in bad condition. She was somnolent, vomited frequently, had double choked discs, marked sensitiveness to percussion over cranium. The left facial in all three branches was paralyzed, nerve deafness on left side and anæsthesia of the cornea. In standing and walking she manifested an exquisite cerebellar ataxia.

All four reactions were strongly positive. Again energetic mercurial course; all symptoms disappeared; the choked discs resulted in partial optic atrophy. Six weeks after the mercurial course the reactions were again made. The Wassermann reaction in the blood had disappeared. The three reactions in the spinal fluid were still positive. Patient again left the hospital because her symptoms were gone.

After a year she returned again, with headache and vomiting. Four days before her return she had developed a right hemiparesis. Objectively in addition to the paresis there was again swelling of the partially atrophic papillæ and slowing of the pulse; all four reactions were positive (the Wassermann in the spinal fluid from 0.5 c.c. up + +).

Again mercurial treatment and potassium iodid. In the course of six weeks the symptoms again disappeared. Three months after beginning treatment the four reactions were negative. In the past one and one-half years she has presented herself twice for control examinations, which have remained negative. No nervous disturbances have appeared.

CASE II.—A merchant, forty-four years old, came under my care. The first time four years ago. He had no knowl-

edge of a specific infection. Two months before he came to me he developed headache and double vision. Two weeks ago a gradually increasing weakness began in his right leg and a feeling of numbness in the left foot. He has always been strong and well before; had suffered no injury and did not use alcohol. There were no external evidences of syphilis. There was a left abducens paralysis. The pupils and eye backgrounds were normal. The skull was somewhat sensitive to percussion. The abdominal reflexes on both sides were absent. The upper extremities were normal except that a slight increase in the tendon and periosteal reflexes was noticeable. On the lower extremities there was slight motor paresis of spastic character. The paresis was more marked in the right leg. There was a disturbance of sensation in the foot and toes of the left foot; with the negative anamnesis multiple sclerosis came into consideration in the diagnosis.

The Wassermann in the blood was + + +. Wassermann in spinal fluid from 0.2 positive. Lymphocytosis + +. Phase I + +.

A mercurial course was ordered, during which the symptoms disappeared in the course of several weeks.

Three months later the reaction was as follows: Wassermann in spinal fluid (before the Auswertungs method) negative. Lymphocytosis + +. Phase I +. Wassermann reaction in blood +.

Six months later a paresis of the lower extremities again appeared and the patient complained of headache. Again another mercurial course re-enforced with salvarsan was given; three months later all four reactions were negative. The Wassermann in spinal fluid negative up to 1 c.c. This patient has continued under observation and two more examinations of his blood and spinal fluid have been made, the last one, three months ago, being negative. He has continued uninterruptedly subjectively and objectively normal.

In both of these cases we see apparently a prompt and complete response, in so far as disappearance of symptoms is concerned, to specific treatment, at first with the reactions remaining positive, later a relapse and a repetition of



treatment, which not only resulted in the disappearance of symptoms, but of the reactions. In both cases, for this reason, we may consider that a complete recovery occurred.

**Recapitulation of Symptoms.**—In the recapitulation of the symptoms of cerebrospinal lues three types of symptoms must be differentiated:

First, those cases in which the brain symptoms predominate in the clinical picture and the spinal-cord symptoms are few and insignificant. These are cases which begin with headache, chronic or periodical attacks of dizziness, unilateral or typical attacks of epilepsy, in which monoplegias or hemiplegias form the chief symptoms, or in which the multiformity of the affection manifests itself in disease of the cranial nerves. In addition to these symptoms, are absence of the patellar reflexes, bladder disturbances, or slight spastic conditions of the lower extremities.

In the second type of cases the reverse occurs. The typical picture of an affection of the spinal cord is presented, which manifests itself as an acute or subacute transverse myelitis which may be regarded as the clinical expression of a vascular softening or a chronic myelitis, the primary basis of which is a disease of the blood-vessels and very frequently also an involvement of the meninges. In such cases sometimes pupil anomalies, headache, dizziness, sometimes optic neuritis, indicate a coinvolvement of the brain.

The third type of cases are those in which both the brain and spinal cord are equally affected. Of the spinal-cord symptoms those of irritation may be the most prominent ones for a long time, which as pain and paræsthesias radiate out from the back into the body and the extremities and cause rigidity, and tenderness of the spinal column to percussion. Symptoms of root neuritis, which one is justified in diagnosing, if in addition to the irritative symptoms atrophic pareses in the extremities occur, may also be the most prominent symptoms for a long time. The motor and sensory paralyses are often incomplete, and on account of the more frequent location of the lesion in the dorsal cord spastic paralysis occurs more often than flaccid. An early involvement of the sphincters takes place frequently.

The most frequent of the cerebral objective symptoms are: disease of the optic nerve in the form of neuritis, choked discs, and partial neuritic atrophy, isolated paralysis of eye-muscles, ophthalmoplegia externa and interna, and loss of the pupil reactions. Of the general symptoms, headache, dizziness, and epileptiform convulsions occur most often.

**Differential Diagnosis.**—The differential diagnosis of cerebrospinal syphilis is concerned chiefly with three diseases: multiple sclerosis, tuberculosis, and multiple sarcomata and carcinomata of the leptomeninges.

**Multiple Sclerosis.**—Multiple sclerosis, the same as cerebrospinal syphilis, may present for a long time a typical picture of a spastic dorsal myelitis. If an optic neuritis and paralysis of the external ocular muscles are added to this, and if hemiparetic conditions occur, the clinical syndrome may for a period absolutely correspond to that of cerebrospinal syphilis. This similarity is still rendered greater by the circumstance that in multiple sclerosis there is also a variation in the intensity, even a well-expressed appearing and disappearing of the symptoms. The course in multiple sclerosis, however, is different. It is more chronic and monotonous and entirely uninfluenced by antispecific therapy. Symptoms which arise from disease which involves the individual basilar nerves by extension do not occur in multiple sclerosis, while, on the other hand, the typical scanning speech and genuine intentional tremor, as well as a true nystagmus which is not caused by paresis of the eye-muscles, are not observed in syphilitic disease of the brain.

One not infrequently encounters cases in which for some time the differential diagnosis remains in doubt. Such a one was that of a young Roumanian who came under my observation several years ago. This patient presented the picture of syphilitic spinal paralysis for almost a year, to which was added an external paralysis of the eye-muscles, without any changes in the backgrounds of the eyes or any disturbances of speech. The anamnesis in regard to lues was not clear. As radiating pains in the extremities, in

addition to grandiose ideas appeared, the existence of a cerebrospinal lues seemed to become more probable, and only when, after an energetic antispecific treatment without benefit, and when later, long after it had been discontinued, the basilar symptoms and the psychic alterations spontaneously disappeared and strong contractions developed in the lower extremities, along with decubitus and cystopyelitis, was the diagnosis of multiple sclerosis definitely made. The autopsy confirmed this diagnosis.

A fact brought out by Dinkler, in 1906, with reference to multiple sclerosis serves to make one still more uncertain as to the differential diagnosis. This is that in multiple sclerosis girdle-like and radiating pains can also occur.

The value of the four reactions in the differential diagnosis of these two diseases will be taken up in another chapter.

**Differential Diagnosis in Tuberculosis.**—In tuberculosis of the nervous system, as in cerebrospinal syphilis, the disease may predominate in either the brain or cord, or affect both equally. As in syphilis so likewise in tuberculosis circumscribed small and large tumors in the form of tubercles occur, also localized and diffuse meningitis, which secondarily infiltrates the nerve substance or passively affects it, and finally, disease of the vessels is found in both, which secondarily leads to necrosis of the nerve-substance. Clinical reports by numerous observers demonstrate how great the similarity may be between the two affections, and, as has already been stated, there are many cases in which only a careful review of all the factors entering into the case will permit a diagnosis.

**Sarcoma and Carcinoma of the Leptomeninges.**—Sarcomatous infiltration may be distributed over the entire nervous system and thereby cause a multififormity in the clinical syndrome.

Siefert reported, a few years ago, some cases which are pertinent here. The clinical picture in these cases resembled very much that of an acute cerebrospinal lues. Both brain and spinal symptoms were coexistent, also the fluctuation of symptoms was present, especially of the pupil

and tendon reflexes, and to such an extent that the cases were almost all regarded at first as hysteria. The course in these cases is usually much more acute than is the case in cerebrospinal lues. The result of lumbar puncture if one finds in the spinal fluid the tumor elements will determine the diagnosis. Lymphocytosis and increase of globulin may occur in both affections. The tumor masses penetrate cone-like into the cord and wall in the posterior roots.

The fluctuation in the intensity of the symptoms may be explained by the change in the fulness of the blood-vessels. The microscopic examination shows that the

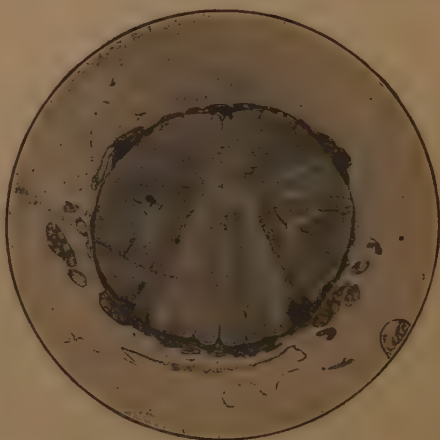


FIG. 94.—Diffuse sarcomatous infiltration of the pia mater (middle dorsal region).

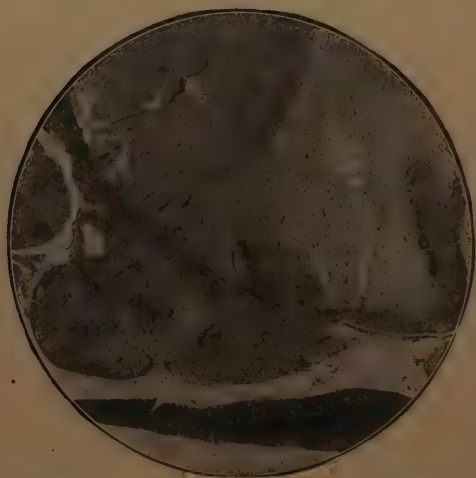


FIG. 95.—Diffuse sarcomatous infiltration of the pia mater.

sarcoma-cells press close upon the walls of the vessels and the extra adventitial lymph-spaces fill up so that the lumina of the vessels are strongly compressed. In this way temporary retardation of the circulation is caused in different regions of the nervous system, which, however, are capable of compensation for a long time.

**Cysticerci.**—It has already been stated that cysticerci may cause a variation in the intensity of symptoms and that in cases of this disease the course may be a longer one.



## XV

### SYPHILITIC DISEASE OF THE PERIPHERAL NERVES

THAT syphilis should also affect the peripheral nerves is easily understood. It is an old experience of the physician that it is the neuralgias appearing in various parts of the body which direct the attention of the patient to his affliction and cause him to seek medical aid.

**Secondary Disease of the Peripheral Nerves Caused by Disease of the Bones, Lymph-glands, Fascia, and Muscles.**—The nerve-roots, both sensory and motor, after their union in the peripheral nerve-trunk and the long course of the nerve-trunk through the different tissues of the body to its termination in the sensory papillæ or the motor end-plates in the muscle, both directly and indirectly and in numerous ways can be involved in syphilitic disease.

The nerves may, in their passage through narrow bony canals, as a result of gummatous periostitis or through gummatous periosteal nodules—as, for example, in the intervertebral foramina, or the bony exits of the cranium—be exposed simply to a compression without any direct involvement of the nerve-stem in the local specific process.

Leyden has stated, in his work on diseases of the spinal cord, that periostitic nerve compression has been assumed more times clinically than it has been demonstrated pathologically. Jürgens has reported a case where gummatous disease of the nerve-roots existed in the lumbar region, together with severe involvement of the periosteum of the bony environment of the intervertebral foramina.

On the other hand, the same observer has reported a large number of cases of congenital syphilis in which he found Wegner's syphilitic disease of the bone in the vertebræ, while the vertebral periosteum was either not affected

at all or only slightly. After their exit from the spinal canal the peripheral nerves may be compressed at any point in their course by syphilitic processes.

There are naturally points of predilection, as, for instance, the large plexes to the extremities where the specifically affected lymph-glands may cause pressure on the nerve-trunks in their immediate vicinity, or in places where the nerve runs on the bottom of a bony groove, as the musculospiral does, or where it is limited in its motion by bands of fascia, as on the head of the fibula.

**Primary Disease of the Peripheral Nerves.**—The injury to the nerve-stem is not always a passive one, such as an atrophy due to pressure, but there often occurs an involvement of the nerve itself, an infiltration of the nerve-sheath, an epineuritis, which in the further advance of the process develops irregular concentric projections, cone-shaped in form, against the axis-cylinder of the nerve-trunk, and thus causes a peri- and endoneuritis.

It follows naturally, since the peri-endoneural septum conducts both blood- and lymph-vessels in the interior of the nerve, that the vessels should appear as the real carriers of the diseased process to the nerve interior. In addition to the chronic traumatic compression atrophy just referred to, the blood-vessels can also cause disturbances of nutrition in the form of simple atrophy, necrosis, and caseation.

**Syphilitic Root Neuritis.**—This condition is best expressed in the cases cited at the end of the discussion of the pathology of spinal syphilis. Kähler was the first to describe it under the name of "multiple syphilitic root neuritis" and it is analogous to the already described forms of the basilar multiple root neuritis of the cranial nerves.

Here likewise the primary leptomeningitic inflammation in the beginning involves only passively the posterior, and not quite so frequently also the anterior, roots, so that thereby pictures are presented which differ in no way from those seen in the peripheral nerves. If now the leptomeningitic induration increases and there is joined with it a pachymeningitic deposit in such a manner that as a result

of the adhesion of the enormously thickened membranes, together with the cord, an inseparable mass results in which the nerve-roots lie firmly imbedded, one can understand the immense pressure effect which may be exerted upon the extramedullary roots.

The peripheral nerves and the extramedullary nerve-roots are subject to specific disease not only through pressure and by secondary extension of the infiltration *per continuitatem*, but also they can be primarily affected without any, or at any rate with only slight, involvement of the meninges, with the gummatous type of syphilis.

The pathological picture which is presented in a primary root neuritis may consist of cylindrical cord-like thickenings or spindle-shaped enlargements strung one after another, like pearls on a string, or, as in a case reported by Baumgarten, grape-like nodular masses in the course of the nerve-roots. These formations may involve both the anterior and posterior roots the entire length of the cord, but are more apt to occur in the cervical and dorsolumbar regions. The cauda equina may also be affected in the same manner, according to Kahane.



FIG. 96.—Primary syphilitic root neuritis. (Buttersack.)

In the majority of cases of primary root neuritis which have been reported thus far, the cord membranes have shown a greater or less degree of chronic inflammatory thickening, and only in the case of Buttersack's were there no essential changes in

the meninges. The inner surface of both the cerebral and spinal dura in its entire course was studded with gummatous nodules, varying in size from a pea to a lentil-seed.

The differential diagnosis between such cases and slow-growing malignant tumor of the vertebræ and meninges would seem almost impossible.

**Peripheral Perineuritis.**—The peripheral perineuritis presents a similar pathology to the root neuritis. In fact, there is not a single pathological finding in the spinal nerves which the clinician cannot observe under his palpating finger in the nerves superficially situated. The nerve-trunk

may be cord-like and thickened, more or less sensitive, or it may show nodular and spindle-shaped swellings along its course.

Ehrmann has observed clinically cases of gummatous perineuritis in the ulnar, crural, and peroneal nerves which responded to antispecific treatment.

In perineuritis the pathological changes consist in peridoneuritis gummosa, arteritis of the vasa nutritia, simple or degenerative atrophy of the nerve-tissue and a greater or less degree of caseous necrosis.

**Simple Specific Degenerative Polyneuritis.**—In regard to the question as to whether there is a syphilitic simple degenerative polyneuritis, it can be said that there are no pathological observations at present that show that the syphilitic poison can cause in the nerve-trunk a simple degenerative atrophy or a parenchymatous neuritis. The clinical fact, also, that well-developed polyneuritis in patients who have previously been syphilitic has responded to antispecific treatment does not directly indicate a polyneuritis in the true sense to have existed. It is much more probable that specific infiltrative processes are present somewhere in the course of the affected nerves which have escaped observation in the objective examination.

The clinical forms of peripheral nerve syphilis manifest themselves as neuralgias, syphilitic neuritis and polyneuritis, and root neuritis.

**Neuralgias.**—The neuralgias appear relatively frequent in the early stages of specific nervous disease, but this is not always true. In two cases reported by Obolensky intercostal neuralgia appeared in one case twenty years, in another eight years, after the infection.

**Neuralgia of the Trifacial.**—In the sphere of the cranial nerves the trigeminal is especially often affected in the form of an isolated and simple neuralgia, as so frequently is seen without syphilis after exposure as so-called idiopathic neuralgia. The neuralgia of the fifth in these cases is analogous to the peripheral facial paralysis which has been described as frequently appearing in the secondary



stage of syphilis. In such cases of trigeminal neuralgia the proof of syphilis in the history and its prompt disappearance under antisyphilitic therapy will establish the connection.

**Neuralgia of the Cervical Plexus.**—Of the spinal nerves the branches of the cervical plexus, the occipitalis major and minor, and the auricularis magnus are more often affected.

Probably in no case of syphilitic neuralgia are the tender spots lacking when pressure is made over the nerve at the points where it comes nearest to the surface.

**The Brachial Plexus.**—Pure neuralgia in the region of the brachial plexus, according to Rumpf, is rare. However, I have seen a number of cases which I considered syphilitic in character.

**Intercostal Neuralgia.**—Intercostal neuralgia has frequently been observed.

The following is a report of a case with several relapses:

A man who, three years before the appearance of his neuralgia, had contracted a syphilitic infection, was seized with severe pains of neuralgic character in the seventh and eighth intercostal nerves on the left side. Both of the nerves were along their course very sensitive to pressure and showed a well-marked hypo-anæsthesia in their entire distribution. No spinal symptoms could be demonstrated. Under antisyphilitic treatment the neuralgia disappeared in two weeks. After six months the pains reappeared in the same region, and again responded to antisyphilitic treatment. After a year's interval the neuralgia appeared for the third time, but this time in the fourth, fifth, and sixth intercostal on the opposite side. This reacted also to appropriate treatment. No other evidences of syphilis could be demonstrated.

**Neuralgia in the Region of the Lumbar and Sacral Plexus.**—

Next in point of frequency to trigeminal neuralgia, according to Rumpf, are the neuralgias occurring in the sciatic nerve of the sacral plexus. Nightly exacerbations of pain are said to be of especially frequent occurrence in specific

neuralgia of this nerve. However, this symptom may be said to have only a limited pathognomonic significance, as pain in all forms of neuralgia may be worse at night.

Seeligmüller and Taylor report the combination of a gummatous nodule in the gluteal region with a severe sciatica of the same side.

E. Mendel, several years ago, reported three cases of syphilitic sciatica. In the first case, as an objective expression of systemic syphilis, there was a gummatous tumor of the parietal bone, in the second case a periostitis of the tibia, and in the third case the sciatica was the only symptom. All three cases responded promptly to treatment. In the first case the infection dated back three years, in the third case ten years, and in the second the history of an infection was negative.

**Syphilitic Neuritis and Polyneuritis.**—Because of the absence of a positive pathology in specific neuritis and polyneuritis, the existence of this condition has not been universally acknowledged. Under these circumstances a certain degree of scepticism is perhaps justifiable, but, in my opinion, it ought to yield in those cases where a positive anamnesis, a striking absence of other etiological factors, objective symptoms on palpation of a perineuritis, and the prompt response of antispecific therapy, strongly substantiate a specific pathogenesis.

The clinical characteristics of a specific neuritis are usually the same as those of a neuritis from other causes.

There are paræsthesias and sometimes severe attacks of pain in the area of distribution of the affected nerves. The paræsthesias are the most constant symptoms. There are almost always well-marked objective sensory disturbances. As has been stated before, there are sometimes found on palpation along the course of the nerve-trunk spindle-shaped nodular swellings or thickenings. In the motor sphere there exists a flaccid paresis or paralysis of peripheral character, which particularly is apt to involve the musculospinal, ulnar, and peroneal nerves. According to the severity of the nerve involvement, there is a greater

or less degree of muscular atrophy in the affected muscles with partial reaction of degeneration. The tendon reflexes are gone.

It is rather rare for a specific neuritis to be localized in a single nerve, and when this does occur the neuritis is usually due to a local gummatous process.

The following case is an example of this:

A servant girl, thirty-four years old, was stricken suddenly with a left musculospinal paralysis. As a cause there was found a tumor the size of a pigeon's egg in the musculature of the left triceps. In addition, there was a general indolent swelling of the glandular system and a slight difference from the normal in the reaction of the pupils. The patellar reflexes were absent. There were no other demonstrable symptoms of syphilis. No specific history could be obtained. Under antispecific treatment both the growth and the nerve paralysis gradually disappeared.

A case of neuritis of the right peroneal nerve:

A merchant, fifty-seven years old, whose specific infection dated back twenty-five years, as the result of a cold developed pains in the toes of the right foot and on the outer side of the right leg. These pains continued for four months, when a weakness in the leg appeared. Objectively there was found a right peroneal paralysis, a hypoesthesia on the outer edge of the foot, as well as a partial R. D. in the peroneal muscles. The trunk of the nerve behind the head of the fibula was sensitive to pressure. A mixed treatment of inunctions of mercury and potassium iodid was instituted, and after the tenth inunction the pain disappeared, and in six weeks the patient was unable to notice any weakness in his leg. The examination of the nervous system otherwise was negative.

**Polyneuritis.**—In specific disease of the peripheral nerves a multiple localization occurs much more often.

In a case which came under my observation the infection occurred twenty-two years previously. The symptoms consisted in pains in the shoulder, paræsthesias and pains of a neuralgic character in the entire area, in a brachial paresis with a diminution of the electrical reaction, in a

cutaneous hypoesthesia of the arms, as well as a sensitiveness to pressure and a slight thickening of the brachial plexus in the subclavian fossa.

Ehrmann reports a case of a merchant, thirty-two years of age, who had contracted lues when he was twenty-six. The patient had a neuritis of the crural and a perineuritis of the peroneal nerve on the same side. As he also had incontinence of the urine, and did not feel the feces when at stool, and an anæsthetic-analgesic zone could be demonstrated around the anal ring, it is probable also that there was a neuritis of the pudic nerve.

In 1901 Cestan published a report of thirteen cases of polyneuritis of specific origin. Two of these cases were remarkable because of the absence of both subjective and objective disturbances of sensation. For this reason, Cestan distinguished three forms of polyneuritis clinically. In the first the symptoms are purely motor, in the second they are both sensory and motor, and in the third pseudotabetic.

The justification of such a classification cannot be disputed, so long as the pathology is lacking.

Nevertheless it should be considered in many cases—as, for example, Cestan's, where a double painless musculospinal paralysis developed with R. D. five weeks after the infection—whether or not a compression of the anterior roots by gummatous infiltration, or a circumscribed meningopoliomyelitis, or an arteritis existed instead of a polyneuritis.

The following case is a typical one of acute specific polyneuritis. It is particularly interesting in this connection, since it furnishes excellent proof in support of the assumption of a specific polyneuritis:

A girl, twenty-two years old, with a specific infection one year old, was, four weeks before her admittance into the hospital, taken sick with paræsthesias in the right upper extremity, followed by a motor weakness in the musculature of the shoulder and upper arm. On examination there was found to be a paresis in the right shoulder-girdle, right upper and lower arm, and in the ulnar region of the right



hand. There was also a weakness in the median and ulnar region of the left hand. There was a partial R. D. Sensitiveness to pressure existed, and there were slight hypoaesthetic disturbances of sensation. The patellar reflexes were absent. No other symptoms could be demonstrated in the lower extremities. Later a complete paralysis gradually developed in the lower extremities in the course of four weeks. Occasionally, in addition to the paræsthesias, the patient complained of severe pains. The cranial nerves were unaffected. The nerve-trunks of the lower extremities were now sensitive to pressure. Four weeks later still there existed a paraplegia of all four extremities, which, through slight sensory disturbances, tenderness of the nerves to pressure, partial R. D., and absence of involvement of the bladder and rectum, left no doubt as to the neuritic nature of the trouble. On the neck there was also present leucoderma. Other signs of recent syphilis were not discovered. Antispecific therapy in the form of inunctions was now begun, and eight days afterwards the first evidences of an improvement in the paralysis became manifest. The improvement continued uninterrupted and in four weeks the patient could move all four of her extremities, and four weeks later was able to stand up and walk around. The neuritic symptoms had all disappeared.

**Polyneuritis in a Patient with Probable Congenital Syphilis.**—A servant girl, twenty years old, was received into my department at Eppendorf because, six days previously, she was taken sick with a paresis of the lower extremities, accompanied by paræsthesias in legs, feet, and hands. This condition increased to such an extent in the course of three days that the patient was no longer able to stand. She had also rather severe pains. Her hands and arms were somewhat weaker than normal. There was no disturbance of the bladder or rectum. Examination revealed a weak, poorly nourished condition. The roof of the nose was sunken in. There was a motor weakness in the hands and arms on both sides. The nerves and muscles were tender to pressure. The tendon-reflexes were present. In the lower extremities the paretic condition was more marked and the tendon-

reflexes were absent. The electric excitability for both currents was diminished, and there was a partial R. D. in the median and ulnar region in the upper extremity, and the peroneal in the lower. Objective sensory disturbances existed in the form of slight hypoesthesia.

No cause for her disease could be ascertained. The hymen of the patient was intact. There was a scar on the uvula, one on the epiglottis, and the vocal cords were thickened, which caused a hoarseness. Her history showed that she was the fifth of five children, and the four who were born before her died during the first week of life. The saddle-nose dated from the first year of life and the hoarseness from the tenth. Antispecific therapy was begun and in five days the patient was able to stand and walk a little. In four weeks the recovery was complete.

**Multiple Specific Root Neuritis.**—Kahler's classical definition best describes the characteristic symptoms of this condition. He says in a syphilitic, or one who has had a syphilitic infection, there may develop along with other symptoms of cerebral lues, sometimes without such, a very stealthy progressive paralysis of the different cranial nerves, which one, where it is possible as in the facial nerve, recognizes as of peripheral character. One cranial nerve after another, in entirely irregular sequence, becomes affected. In addition to these symptoms, a slowly increasing neuritis appears in the region of the spinal nerves, accompanied by hyperesthesia or a girdle-sensation and girdle-pain as a consequence of progressive disease of the posterior spinal nerve-roots.

Motor paralyzes indicate involvement of the anterior roots.

In Kahler's case, which formed the basis of the above-described symptom-complex, the patient was a young man, twenty-nine years old, with an ulcer on the penis. He was stricken three months after his infection with a left-sided hemiplegia and dysarthria without apoplectic symptoms. In six months' observation of the patient there was added to the clinical picture, first left, then right facial paralysis of a peripheral character, then symptoms of paralysis of

both oculomotor nerves and vasomotor phenomena in the skin of the face. There was also a severe neuralgia in the region of the occipital and some of the intercostal nerves.

In a case reported by Remak the specific infection was twelve years old. The patient had complained of pain for months in the neck and shoulder, which was followed by weakness in the shoulder musculature. In addition to exostoses on the right clavicle and upper cervical vertebrae, with severe cervicobrachial neuralgia, there was a marked atrophy of the shoulder-girdle and the flexors of the upper arm, paralysis of the accessory, the long thoracic, paresis in the region of the left musculospiral and the diaphragm, paralysis of the vocal cords, absence of the patellar reflexes, and R. D. in the trapezius, sternocleidomastoid, biceps, and supinator longus muscles.

This case furnishes a very good confirmation of the characteristics of root neuritis as described by Kahler, but it also shows that spinal-root symptoms can be present without any marked involvement of the cranial nerves. As a result of further pathological observations Kahler's conception must be somewhat modified in that these observations have shown it is not possible to differentiate between independent gummatous root neuritis and the compression of the roots which may result from a pachy- and leptomenigitic infiltration or induration.

The observations of Jürgens, Baumgarten, and Wieting also show that frequently gummatous processes in the roots are combined with gummatous inflammation of the spinal meninges.

According to my experience, the syphilitic polyneuritis can to a certain extent be differentiated from the root neuritis, because in the latter the pains are usually of great severity and long duration, they are also of a lancinating, tearing nature and are increased by movement of the vertebral column, shaking or jarring of the body, and coughing and sneezing. The pareses and paralyses which follow the pain do not have the universality of involvement which is found in the polyneuritis, but resemble more the spinal segment type.

On the other hand, in polyneuritis paræsthesias are more frequently observed, the pains are not so severe and stubborn, the paralyses usually involve the extremities, and sensitive points and neuromuscular tenderness are almost always present.

Oppenheim and Eisenlohr have directed attention to the fact that specific root neuritis may present symptoms which resemble tabes and can be designated as a pseudo-tabes syphilitica.

Concerning this condition we have already spoken in another chapter. One point, however, should be emphasized here. In the cases described by Eisenlohr it was remarkable that in the beginning the neuralgia was limited more to the regions of isolated nerve-trunks like the sciatic and it stubbornly persisted in this area. Only in the further course was the character of the pain similar to that in tabes. It was then lightning-like, raged in the entire extremity, in the bones, flesh, everywhere, in short, it radiated out of the sphere of the single nerve-trunk and involved the whole limb. There were also frequently fixed pains in the gluteal and neck regions. In individual cases the vertebral column was constantly sensitive to pressure, and during the entire course of the disease there was rigidity of the neck.

This rachalgia, especially if it is increased by passive and active movement of the vertebral column, may have a pathognomonic significance ascribed to it, inasmuch as its constant presence makes probable an involvement of the pachy- and leptomeninges by a syphilitic process.

In conclusion it can be said that the root neuritis described by Kahler, although it has a pathological significance, clinically it can only claim independent significance with the following supplementary statement. In not only primary gummatous processes in the anterior and posterior roots but also as a result of specific pachy- and leptomeningitic indurations the appearing compression of the same produces an almost identical picture, which is characterized by the early development of intense neuralgias and rachalgias with subsequent atrophic paralyses.



## XVI

### HEREDITARY SYPHILIS AND THE NERVOUS SYSTEM

**Congenital Syphilis Affects the Nervous System.**—In the discussion of the influence of syphilis on the nervous system we must also consider hereditary syphilis. The nervous system may be affected in many ways by inherited syphilis.

The opinion has been held for a long time, and Heubner has recently restated it, that hereditary lues originates in children in the following manner: Either the male or female generative cell, or both, contains the contagion of syphilis and this contagion develops in the new growing organism directly from the generative cell and changes it pathologically.

**Extra-uterine Infection.**—In the beginning of our knowledge concerning syphilitic disease, the existence of a hereditary syphilis was not believed, but it was thought in all cases, *post partum*, that a transmission of the poison to the new-born had occurred. The wet-nurse in such cases received the chief blame.

It may be mentioned here that an especially thorough examination for an extra-uterine infection should never be omitted. As illustrative, the following pertinent observation is given:

Convulsions appeared on the left side of a child eleven months old, after which a hemiparesis remained. It was ascertained that the child had a chancre on the tongue and was nursed by a syphilitic nurse.

**The Spirochæte pallida.**—The *Spirochæte pallida* is found regularly in large numbers in the nervous system of the hereditary syphilitic fœtus as a part of the general invasion of the fetal tissues. Since the proof of the spirochæte in specific nervous diseases in the adult is very diffi-

cult—and, up to the present time, except in gummata, they have not been found—it should be pointed out here that their presence in the nervous tissues in the fœtus is only an expression of their general invasion of the fetal organism.

**Fundamentals in Hereditary Lues.**—The most important points to be remembered in regard to hereditary syphilis, and which stand at the present time undisputed, may be summed up under four headings:

1. In by far the greatest number of cases syphilis is transmitted by the husband to the wife; that is, hereditary syphilis of the child usually can be attributed to the father.

2. The wife can be infected by her husband either before the conception or at the time—usually before. In either case the syphilis of the child is contracted from both father and mother.

3. A wife may conceive from a syphilitic husband, without herself becoming infected. The syphilis of the fœtus then is received from the father. The mother may become infected secondarily from the syphilitic fœtus. However, this does not necessarily follow. The influence of the luetic fœtus on the mother is shown by the circumstance that if she then remains free from any symptoms of syphilis, she becomes immune to specific infection. Formerly the statement in the last sentence was thought to be true. At present we know that in the majority of cases the blood of the mother shows a positive Wassermann and this proves that the mother was not immune, but syphilitic, although her infection may be latent.

4. It can also happen that both father and mother, at the time of conception, are free from syphilis, but later, during pregnancy, the mother becomes infected. In such cases the maternal and fetal placenta must be infected.

From these statements one recognizes how complicated the relations may be, and how difficult or impossible the anamnestic proof of syphilis with reference to hereditary syphilis often is.

**The Attenuation of the Specific Virus.**—The well-known teaching of the gradual lessening of the syphilitic virus

which is shown in abortion, the premature birth of dead children, premature birth of living syphilitic children, the birth of full-term children which immediately show specific symptoms, or who later develop them, and the later birth of healthy children who remain healthy, has many exceptions.

Werner, in Engel Reimer's clinic at the Hamburg General Hospital, has recently shown that not infrequently a healthy child may be born in between two syphilitic ones. This confirms Fournier's teaching that with a history of lues in the parents the birth of a healthy child is no guarantee for the future.

**Severity of Parental Syphilis Does Not Always Correspond to the Degree of Congenital Lues.**—The severity of the parental syphilis does not always stand in direct proportion to the degree of hereditary syphilis. The severity of the parental syphilis is without influence on the frequency of hereditary syphilis. This is true for hereditary syphilis in general, as well as for the acquired and hereditary syphilis in particular developing in the nervous system.

With reference to the acquired syphilis, a case reported by Gilles de la Tourette and Fournier furnishes a good illustration. In this case the husband had an exceedingly mild type. In the wife an unusually malignant nervous syphilis developed in the brain and spinal cord.

The literature shows that in many severe cases of hereditary syphilis the symptoms of specific disease in the parents were so mild that they had not been observed. Consequently, the anamnestic proof of syphilis could not be obtained.

**Syphilis of the Parents May Have Occurred a Long Time Back.**—It is important to know that the inheritance of syphilis may take place although the parental infection has occurred years before. Fournier has reported a case in which the interval was fifteen years, Molenes one in which the interval was twenty-two years.

**Frequency of Involvement of the Various Internal Organs in Hereditary Syphilis.**—The most frequent autopsy finding in hereditary syphilitic children, who have manifested the

usual picture of a hereditary syphilitic exanthema and coryza, is that of marasmus. All the organs of the thorax and abdomen can, however, become specifically affected. According to Heubner, the following is the order in point of frequency: bones, liver, lungs, spleen, alimentary tract, heart, blood-vessels, and nervous system. Rumpf gives the percentage of nervous involvement as 13 per cent. in hereditary syphilis.

**Late Hereditary Syphilis.**—In hereditary syphilis not infrequently years may elapse before tertiary lesions of the skin and bones, as well as the internal organs, including the nervous system, appear. One speaks then of syphilis hereditaria tarda. Various opinions are held as to whether these tertiary symptoms can appear in children who after their birth have never shown any evidences of syphilis. The chief champions of this possibility are Fournier, Rabl, and Dühring. Naturally the objection can be made that one can never be certain that secondary symptoms have not been present *intra vitam*, and have thus escaped observation.

**Time of Appearance of the Late Symptoms.**—According to Zeissl, Anganeur, and Wolff, these late symptoms are the most apt to occur during the age of puberty. Fournier, from 212 cases partly observed by himself and partly collected from the literature, places wide limits for the appearance of these symptoms, from the third year up to the twenty-eighth year, with the maximum of frequency around the twelfth year. Lepine and Charcot report a case of late hereditary lues with brain symptoms in the thirty-second year of age.

At any rate, it is certain that the infant, in a small proportion of the cases, can remain free from relapses for a long time, and that, with the relapses in the skin and mucous membranes, often gummatous processes appear in the internal organs in the above-stated frequency.

The same granulation tissue is found in the internal organs as is found in adults, only it is worthy of mention that there seems to be more inclination to diffuse infiltration than to circumscribed tumor formation.



**Symptoms of Hereditary Syphilis Apart from the Nervous System.**—The manifestations of syphilis, or evidences thereof, often suggest the specific nature of nervous disturbances in children. An osteochondritis which was first described by Wegner, and consists of a disturbance of the ossification in the cartilage zone on the epiphyseal border of the long bones, which leads to a separation of the epiphysis because of the formation of syphilitic granulation tissue, should be mentioned. Also coryza, and a macular, papular, or pustular specific exanthema, a scaling of the epidermis on the palmar surfaces of the hands and plantar surfaces of the feet, onyxia, the deformity of the teeth described by Hutchinson, rhagades, and nervous deafness are among the symptoms.

Hyperostoses are frequently seen on the cranium, especially on the frontal bone. There is often an extreme thinning of the cranial bones in hydrocephalus. Microcephalia occurs not infrequently. The so-called saddle nose is often found. The scapula shows very often the form of the scaphoid scapula, which was first called attention to by Graves, of St. Louis. Graves found this form of scapula most often as occurring in congenital syphilis. Kellner found, from a large experience, that this form of scapula was by no means limited to cases of congenital syphilis but that 60 per cent. of his cases of congenital syphilis had this type of scapula. He found it, also, as occurring where there was a history of alcoholism and tuberculosis in the ascendants.

Edgar Reye, in my clinic, has examined 52 families where the children showed this type of scapula, making a Wassermann examination in all cases. In 50 per cent. of the cases he found lues in the ascendants; in the other 50 alcohol, tuberculosis and other injurious factors. Warburg examined in Cologne 1000 school children and came to the conclusion that a concave medial edge of the scapula was not only not pathognomonic of syphilis but could not be regarded as a stigma of degeneration. He thought this form of scapula might be regarded as a normal variety but occurred perhaps in weak children more often than strong.

**Eye Symptoms.**—Excluding the optic nerve and the external and internal eye-muscles, an examination of the eyes will still furnish much evidence for the diagnosis of hereditary syphilis. A careful examination of the eyes in suspicious cases is absolutely necessary. In the choroid one should look for pigment deposits and choroiditic spots which have been left after a choroiditis; in the retina, for inflammatory processes with and without involvement of the choroid; in the lens, for opacities, usually dust-like in character. The iris should be examined for inflammatory or gummatous disease, as well as synechias; the cornea, for evidences of an existing or past interstitial keratitis. Diseases of the tear-duct and sac due to hereditary syphilis, in the form of dacryocystitis-scars and periostitis of the walls, also occur.

**Pathology of the Nervous System in Hereditary Syphilis.**—The pathology of congenital lues of the nervous system must also be classified into genuine specific syphilitic changes and non-specific syphilitic changes.

With reference to the non-specific pathology, Jarisch found in children who in infancy had an exanthema and died without manifesting any particular nervous symptoms a decrease in the number of ganglion-cells, a change in the protoplasm of the cells, and vitreous masses around the vessels in the central nervous system. These findings are, however, of too general a nature to be acknowledged as fundamental. Jarisch considers them as an evidence of a diminution in the general resistance of the nervous system due to the influence of congenital syphilis.

Sibeliu holds a similar opinion. This observer found in his examination of the central nervous system in hereditary lues in the spinal ganglia, groups of partially abnormal ganglion-cells which were probably due to delayed or abnormal development. In the very severe cases of congenital lues these colonies or groups could be frequently demonstrated, and in large numbers. Sibeliu regards the occurrence of these colonies with marked atypical ganglion-cells as the result of restricted development produced by the syphilitic toxin.

**Defective Development.**—The severe forms of defective or restricted development of the central nervous system are very important, and to a certain extent characteristic of congenital lues. Since the harmful influence of syphilis transmitted from the parents to the fœtus encounters first the developing central nervous system, this is not infrequently retarded in its harmonious development and there result extensive deformities or malformations which are not compatible with the extra-uterine life of the fœtus.

Ilberg described the central nervous system of aluetie child, six days old, in whom both the liver and spleen showed specific syphilitic changes. In this case the entire medullary substance of both hemispheres of the cerebrum, the corpus callosum, the anterior commissure, the fornix, and the corpora mammillaria were lacking. There were also lacking the entire pyramidal tracts as far as the spinal cord, asymmetry of the cerebellar hemispheres, and developmental deficiencies in the nerve-fibres in the optic tract.

It should be stated here that developmental malformations of all kinds may be caused by other influences than parental syphilis, as injuries and chronic intoxications. Congenital lues, however, in the causation of malformations of the brain and spinal cord, plays a very important part.

**Hydrocephalus.**—A comparatively frequent and early-recognized malformation of the brain in hereditary syphilis is hydrocephalus. Mendel has published a *résumé*. He states that Haase, in 1828, reported the case of a woman who was infected by her husband. This woman gave birth to three premature still-born children, and then a full-term child which died in its seventeenth month with hydrocephalus.

Rosen published, in 1862, a number of cases of congenitally syphilitic children who died in the first years of life with hydrocephalus.

Many such cases have been reported, in which, in addition to a greater or less degree of hydrocephalus, there was also specific disease of the brain.

In many cases a syphilitic arteritis is probably the cause of the hydrocephalus, and primarily also the cause of the

congenital malformations produced by the hydrocephalus. The vessel disease promotes the exudation of lymphatic fluid in early intra-uterine life, which causes a watery accumulation in the brain-vesicles and the central canal.

Heubner saw as the cause of a hydrocephalus in a congenitally syphilitic child a well-developed pachymeningitis hæmorrhagica.

According to Biedert-Vogel congenital chronic hydrocephalus, in many cases, is due to a syphilitic induration of the brain-meninges and displacement of the vessels.

Hochsinger, several years ago, made an exhaustive study of specific hydrocephalus in infancy from 35 cases. In 34 of the 35 cases, in addition to the hydrocephalus, syphilitic symptoms in the form of coryza, exanthema, bone, spleen, and liver affections were present. The beginning of the hydrocephalus occurred in the majority of the cases between the third and eleventh months. In six cases it began during the fetal life. In 11 of the cases there were no nervous symptoms. The nervous symptoms, when present, were manifested in restlessness, insomnia, chronic vomiting, contractures, and convulsions, idiocy, nystagmus, and increase of the tendon-reflexes. In a few of the cases the clinical picture resembled tubercular meningitis very much.

Audeont and Haller report three cases of specific hydrocephalus in hereditary lues which disappeared under anti-specific treatment.

Concerning the frequency of hereditary lues as the basis of infantile cerebral palsy the opinions of different observers vary. Fournier was able almost always to demonstrate syphilis in the anamnesis of the parents or other antecedents of the affected children. He and Gilles de la Tourette have described cases of Little's disease (congenital spastic paralysis) as occurring in hereditary lues.

Heubner, Erlennmeyer, and Franke also consider that a relationship between infantile cerebral paralysis and congenital lues frequently exists. It seems to me, however, that in the true infantile encephalitis, syphilis, as an etiological factor, does not play a very important part. Oppenheim holds the same opinion. Sachs, who has had an espe-



cially large experience in the encephalitic paralyses of childhood, in 200 cases was able to demonstrate congenital lues in only two. The most important etiological factors in the causation of this disease appear to be birth injuries and acute infectious diseases.

**Brain Apoplexy.**—Brain apoplexies are likewise of rare occurrence in congenital lues. In spite of this, however, numerous cases have been reported in the literature. The case reported by Gowers is perhaps the best known. This was of a boy, twelve years old, with congenital lues, who died suddenly of a brain apoplexy which ruptured into the ventricle. The autopsy revealed specific disease of vertebral and deep cerebral arteries as the cause of the hemorrhage.

**Disease of the Blood-vessels.**—Heubner's arteritis is also found in congenital lues.

The endo-, meso-, and periarteritis may represent the only pathological change, or it occurs, as in the majority of the cases, along with pachymeningitis, gummatous processes, and diffuse sclerosis.

**Disease of the Meninges.**—A pachymeningitis hemorrhagica interna has been reported by Heubner, Spiller, Waldeyer, and Köbner. Hemorrhages between the pia and the brain-cortex and in the ventricles have been described by Virchow. Gnopf has reported a case of gummata in the meninges in a child thirteen weeks old, which evidently originated intra-uterine.

**True Specific Nervous Disease in Congenital Lues in Combination.**—The genuine syphilitic diseases of the nervous system in congenital lues are found almost always in combination. When syphilis appears in congenital lues later in life the processes do not then differ from those found in the adult, where the lues has been acquired. We find here also lepto- and pachymeningitic processes, miliary gummata, and large gummatous tumors, Heubner's endarteritis, with secondary softenings, and neuritis gummosa side by side.

The most frequent findings of these various processes are likewise the arterial and gummatous affections. The latter condition occurs most often in the form of a diffuse

infiltrating gummatous meningitis, or meningoencephalitis and meningomyelitis. At the same time isolated multiple gummata are of frequent occurrence.

The following two cases are notable ones of hereditary lues of the nervous system:

Case reported by Siemerling: syphilitic neuritis of the optic and motor oculi nerves, circumscribed and diffuse gummatous infiltration of the dura, arachnoid, and pia mater, meningoencephalitis gummosa, syphilitic arteritis, specific gummatous infiltration of the spinal-cord membrane, and sclerotic changes in the posterior columns.

Siemerling's case illustrated the multiplicity of the findings. The nervous disease appeared in the sixteenth year of age.

Pick found in a child fourteen months old gummata in the frontal lobes and obliterating endarteritis of the cerebral arteries.

**Isolated Spinal-cord Syphilis Probably Does Not Occur in Congenital Lues.**—I have never seen in my own experience, nor have I ever found in the literature, a case reported of pure spinal lues in congenital syphilis. The spinal cord usually becomes involved in the form of disease of the arteries and veins, circumscribed and diffuse infiltrating gummatous tumors, meningitis, and root neuritis.

**Summary of the Pathological Changes.**—All the changes in the blood-vessels, the meninges, and in the nerve-substance itself, which have been observed in acquired lues, occur also in congenital lues. Multiple parts of the nervous system are more frequently affected in congenital lues than in acquired, and the various types of brain syphilis, meningitis, gummatous formation, and arteritis are found often in combination. Scleroses side by side with genuine specific processes also occur, as well as postsyphilitic systematic degenerations analogous to those in acquired lues.

**Clinical Symptoms.**—The influence of syphilis on the nervous system in childhood shows itself more clearly than later in life, because in the child the presence of other etiological harmful factors, as alcohol, trauma, physical

overexertion, and psychic shock, is lacking. On the other hand, early involvement of the central nervous system is particularly injurious because it is attacked during its developmental period.

**General Debility or Lack of Vitality.**—The children of syphilitic parents very often show clinically defective vitality and general weakness.

Werner has shown from 167 children in Engel Reimer's clinic, whose mothers were syphilitic, that 75 per cent. died. In the children who were manifestly luetic 63.5 per cent. died within the first year, in those who were not, 50 per cent. It appears, therefore, from Werner's statistics, that a child of luetic parents, although it may be apparently free from congenital lues, even though it possesses strength enough to develop to a certain extent, nevertheless, in comparison to the offspring of healthy parents, has suffered greatly in its resistance. Objectively this diminution in vital resistance is shown in the digestion, diarrhœas, disposition to infectious diseases, and anomalies of development.

It is not generally known that otherwise healthy children, whose fathers were syphilitic, show a striking lack of resistance to infectious diseases.

This general state of debility not infrequently manifests itself predominately in the nervous system. Such children are inclined to epilepsy or infantile convulsions.

**Nervous Form of Rickets.**—Rickets appears in them in the nervous form; that is, the children from slight causes are liable to develop eclamptic convulsions. Heubner explains that such cases are due to the indirect consequences of syphilis, since after their death one may search in vain through the entire central nervous system without discovering any visible cause.

According to Schuster, eclampsia often occurs in infants who come from parents with latent syphilis. Meningitic symptoms, appearing in the form of contractures of the musculature of the neck and extremities, somnolence, and coma, also severe glottis spasm, may appear in children with congenital lues during the first year of life, and later cause death, and at the autopsy remain unexplained.

Not infrequently an old specific infection of the father, which has lingered for years, shows itself in the child simply in the form of an irritable weakened nervous system.

**Simple Nervousness.**—I saw this condition particularly well expressed in a child five years old. The father of the child had been infected with lues six years before the birth of this child. Two years before its birth he had been treated for a specific iritis. The mother was not infected. Neither parent was nervous, and the subsequent offspring did not show any neuropathies. This child from the very beginning was easily excited. Later it suffered much with headache, abnormalities in disposition, stubborn insomnia, and irregular appetite. A dietetic regimen combined with tonic measures was of no benefit. The child was brought to me and thoroughly examined without finding any manifest symptoms of lues. However, as I had previously diagnosed the iritis of the father, I prescribed large doses of potassium iodid for the child, with the result that the sleep returned, the abnormal irritability was lost, and the little patient improved in every way. At the present time, after twelve years, this child is a normal, healthy girl.

I regard these cases as very important, and since one can scarcely find anything concerning them in the literature, I will briefly report two more.

One case was that of a boy, four years old, who was very intelligent, rather prematurely developed, without any signs of rachitis, degeneration, or syphilis. He was very restless in his sleep, had periods of depression, and abnormally frequent erections. The father had married five years before and ten years before had syphilis. He had taken his last antisppecific treatment just before his marriage. Further observation of the child in the hospital did not reveal anything new. Sedative and constructive treatment did not produce any improvement. Then I began with an energetic administration of potassium iodid. From this time on a striking improvement took place, which lasted, under the continuation of the medication, for about a year, when I lost sight of the boy.

In another case of a little girl, four years of age, whose



mother was healthy, the father had contracted syphilis eight years before, and was thoroughly treated at that time. This child was also easily excited and prematurely developed. She kept the family in terror because of her mental and physical unrest, and also sleeplessness. In this case potassium iodid used in large doses was likewise very efficient.

These cases show that a genuine irritability, psychic unrest, and particularly disturbances of sleep in children may be an expression of inferior nervous strength due to a previous syphilis in the father.

**Hysterical and Hysteroid Conditions.**—In other cases one observes hysterical attacks or symptoms of nervous weakness which we would call in the adult cerebral neurasthenia. Intercurrent nightly headaches, sudden attacks of dizziness, and epileptic seizures direct our attention to the true nature of this nervous condition.

The situation becomes especially grave if a change in character is manifested, when along with mental weakness there are sudden outbursts of anger, wilfulness, and rudeness, or a retardation in the mental development sets in.

These psychic anomalies usually appear after the second dentition. In two cases of developing young girls I saw a moral idiocy show itself. Both cases were from good families and were brought up in a good social environment, yet they consorted with men, stole, and lied. Confinement in a reform school did not improve them. Stigmata of congenital lues were lacking, the physical development did not reveal any anomalies, and the intelligence, in so far as advancement in school was concerned, was normal. In one of the cases the father had contracted syphilis eight years before the birth of his daughter, in the other ten years before.

**Migraine May Also be an Expression of Congenital Syphilis.**

—Halban devotes considerable space to the question of symptomatic hemicrania in his monograph on juvenile tabes. He believes that without paresis and tabes, congenital lues can cause specific migraine attacks; in other words, hereditary lues during puberty may find its only manifesta-

tion in hemicrania. I have observed a number of such cases in which the attacks of migraine were relieved by the administration of potassium iodid.

**Psychoses.**—The psychoses which occur in acquired lues are found also in congenital lues.

**Symptoms of Hydrocephalus.**—Symptoms of hydrocephalus appear sometimes in the form of disturbances of consciousness, mydriasis, or myosis with slowness of the light reaction, vomiting, bradycardia, partial and general convulsions, pareses, and muscular rigidity, which may increase to contractures.

**Symptoms of Arteritis.**—Arteritis causes, as in adults, conditions of hemiparesis and paralysis, which may be ushered in by unilateral or general convulsions and lead to contractures of various kinds or degrees. There may or may not be loss of consciousness. The same is true in regard to aphasia.

**Mental Weakness and Idiocy.**—Diminution of the intelligence in slight and severe degree, comparatively often reaching idiocy, is a frequent occurrence in congenital luetic disease of the nervous system.

Bary reports six cases of idiocy or dementia due to hereditary syphilis. Such cases must in my opinion be considered as cases of cerebral lues, in which idiocy is only a symptom.

This was true in the case of Spielmeyer's. Three children of a father who had been syphilitic were taken sick with epileptic convulsions, rapidly developing dementia and blindness. The autopsy in one of the children who died revealed diffuse disease of the central nervous system.

Binswanger found in 74 cases of idiocy that lues could be demonstrated in the father in seven with absolute certainty, and with probability in nine.

Ziehen found congenital lues in 10 per cent. of his cases of idiocy as certain, and as probable in 17 per cent. He reports the case of a feeble-minded girl thirteen years old, with loss of the knee-jerks. Under energetic anti-specific treatment the knee-reflexes returned, as well as the intelligence.

Plaut in his well-known monograph on the subject of congenital syphilis, in which he reports the first cases of family serological examinations, shows how important it is not only to examine the parents and other children where there is a suspicion of congenital lues in the old way, but, also, to make serological examination. My own examinations, made by Hauptmann and more recently Raven, show as a matter of fact that when the examination is made in this manner, with the parents and other children in the family, many more positive results are obtained. Examinations conducted in this way would probably show a much larger percentage of lues in cases of idiocy and mental defectives than is at present shown. The following cases illustrate both the stigmata of congenital lues, and what may be ascertained if the attempt is made in the right manner:

1. W., thirty-nine years old; date of infection fifteen years ago; married; epilepsy due to lues. Wassermann in blood + + +. Wassermann in spinal fluid 0.2  $\theta$ ; 0.5 + + +. Lymphocytes 123/3. Phase I + +.

Wife, Wassermann in blood,  $\theta$ ; pupils irregular, reaction sluggish.

Son twelve years old, Wassermann in blood  $\theta$ , scaphoid scapulæ.

Son ten years old, Wassermann in blood + + +, scaphoid scapulæ.

Son nine years old, Wassermann in blood  $\theta$ , Hutchinson teeth.

Son seven years old, Wassermann in blood  $\theta$ , high arch palate, rachitic teeth.

Daughter five years old, Wassermann in blood  $\theta$ , scapula, left, scaphoid.

2. L. aged fourteen years. Phase I + + +. Lues congenita Pandey + + +. Lymphocytes 46/3. Wassermann in blood + + +. Spinal fluid Wassermann 0.2 + + +.

Sister ten years old, objectively nothing to report. Wassermann in blood  $\theta$ .

Two sisters, small.

Mother forty years old, objectively nothing to report. Wassermann in blood + + +.

Father, paresis.

3. Wife infected before marriage; inunction course. Wassermann in blood ++. Two abortions.

Husband infected before marriage; paresis.

Son, twenty-one, stationary tabes; four reactions +.

Daughter, anæmic, delicate.

Daughter, potator, homosexual.

Son, healthy.

4. O. forty-one years old; tabes dorsalis; infected when twenty-three years old. Total optic atrophy. Wassermann in blood +++.

Wife thirty-six years old. Wassermann in blood  $\theta$ . Aortitis lueca.

Daughter sixteen years old. Wassermann in blood  $\theta$ . Easily excited.

Son fourteen years old. Wassermann in blood  $\theta$ . Scaphoid scapulæ.

Daughter thirteen years old. Wassermann in blood +. Rhachitic teeth; anæmic; outbursts of anger; when young, convulsions.

Daughter twelve years old. Wassermann in blood +. Somatically normal.

Son ten years old. Wassermann in blood  $\theta$ . Somatically normal.

Daughter nine years old. Wassermann in blood +. Scaphoid scapulæ.

5. F. ten years old. Paralytic attacks. Argyll-Robertson pupils; juvenile paresis, mentally, typical. All four reactions +++.

Father, paresis. Four reactions +++.

Mother, tabes dorsalis. Wassermann in blood +++.

Seven abortions. Child, small, convulsions.

6. D. H. fifteen years old; juvenile paresis. Both pupils with light reaction lost on both sides; foot and patellar clonus. High degree of ataxia. Double optic atrophy. Wassermann in blood +++.

Wassermann in spinal fluid 0.2 +; 0.5-1.0 +++.

Lymphocytosis 38/3. Child born December 25, 1913, healthy. Wassermann in blood +++.



Father, lues when nineteen; several inunction courses. Married when twenty-seven. Wassermann in blood + + +. No evidences of tabes or paresis.

Mother, physically and mentally good. Knows nothing of an infection. Wassermann in blood negative.

Sister fourteen years old; blind since four years old. Past evidences of keratitis parenchymatosa.

Brother twelve years old; delicate; anæmic; looks like a degenerate. Wassermann in blood 0.

Brother seven years old; delicate; anæmic; looks degenerate. Wassermann in blood 0.

**Epilepsy.**—Epilepsy in its various forms is quite frequent in congenital syphilis.

Comprehensive statistics concerning frequency of the relationship between hereditary lues and epilepsy are lacking. Veit, in the epileptic institution at Wühlgarten, found this relationship existing in 7 per cent. of the cases. Bratz and Luth, in 400 epileptic children, found in 5 per cent. of the cases syphilis in the parents. In these the cases with multiple brain symptoms and convulsions are excluded.

The epilepsy either appears as symptomatic, as the expression of organic disease of the brain, or as the so-called idiopathic epilepsy.

In all cases of epilepsy either with or without mental feebleness in children one should always consider the possibility of a hereditary luetic basis. Binswanger, in his monograph concerning epilepsy, emphasizes the point that congenital lues is a much more frequent etiological factor in causation of epilepsy than has generally been supposed. He speaks of a dyscrasic form of congenital syphilitic epilepsy, in rhachitic, scrofulous, anæmic children in whom lues in the anamnesis is frequently revealed as the cause. In such cases there exists a germ damage or injury in contradistinction to a germ infection, which is distinguished by the pathology.

One of my cases, a child eight years old, the father, several years before its birth, had been syphilitic. This child was normal in both mental and physical development, with the exception of some backwardness in learning to talk. In its seventh year, without any apparent cause, epileptoid

attacks set in, which gradually developed into true epileptic attacks. Symptoms of congenital lues were lacking on the skin, mucous membrane, and bones, but as stigmata of lues of the nervous system there were found double mydriasis and loss of the pupil light reactions.

Under mixed treatment (mercury and potassium iodid) the epileptic attacks became less frequent. At the end of a year the child passed from under my observation.

**Basilar Cranial Nerve Paralyses.**—Paralyses of individual cranial nerves may be the only symptoms presented. In a case reported by Gräfes, of a two-year-old child who became blind through a specific iritis, there developed, several weeks before it came under Gräfes's observation, a left-sided ptosis. Objectively there was found a divergent strabismus and mydriasis on the left side, together with a papular syphilide. Antispecific therapy influenced only the syphilide. The postmortem revealed an area of softening in the left corpus striatum and in the right hemisphere, as well as gummatous tumors in the sheath of the left oculomotor nerve.

**Paralysis of the Eye-muscles Less Frequent in the Congenital Than in Acquired Lues.**—Cases of paralysis of the eye-muscles are in general less frequent in congenital than in acquired lues.

The paralysis of both the internal and external eye-muscles, with hemi- and paraplegias, as well as with dementia or idiocy, appears relatively often.

**Isolated Loss of the Light Reaction.**—The loss of the light reaction of the pupil has been observed also in congenital as in acquired lues as the only somatic symptom.

Finklenberg has reported the case of a boy eight years old who presented, as the only objective symptoms of an inherited syphilis, mydriasis and loss of the light reaction. The boy up to that time had been healthy. The father of the boy had syphilis, and later tabes. The mother had aborted several times and also given birth to feeble children.

As an accompaniment of other brain symptoms a disturbance of the function of the pupil occurs very often. König considers the loss of the light reaction, together with

mental feebleness, with very rare exceptions as a certain sign of hereditary syphilis.

**Polyuria and Glycosuria.**—Demme reports a case of polyuria and transient glycosuria in a boy six years old, which disappeared and then reappeared after a year. Both of these conditions were entirely relieved by antisyphilitic treatment. Demme describes the case as one of hereditary syphilitic basilar meningitis.

**The Optic Nerve.**—The optic nerve is also frequently involved in congenital luetic basilar meningitis. Oppenheim has directed attention to the fact that along with specific basilar meningitis, which in acquired lues is the chief cause of neuritis and atrophy of the optic nerve, in congenital lues hydrocephalus also appears as a not infrequent etiological factor.

The following case is one of hereditary syphilitic disease of the optic nerve:

The patient was a boy, fifteen years old, who was born as the only living child after a number of miscarriages and still-born children. The father was treated for syphilis repeatedly, the last time about one year ago. The child was from the beginning a weakling. He learned to walk late and was late in teething. He began to talk first when he was three years old, and at six he talked with difficulty. From this time on his mental development remained stationary. Convulsions or epileptic attacks never occurred. When the boy was fourteen he became blind, in the course of several months, in the right eye. Two months ago the sight of the left eye began to fail. Objectively the cranium was remarkably small and lacking in symmetry. There were also Hutchinson teeth, anisocoria, complete paralysis of the pupils, on the right side, a total neuritic atrophy, and on the left side, in addition to an acute optic neuritis, there was a disseminated chorioiditis, as well as dust-like opacities in the lens.

In this case, because of the appearance of the choroid and lens without the anamnesis, the diagnosis of a congenital specific affection of the optic nerve could have been determined. Antisyphilitic treatment caused the optic neuritis

to recover and limited the atrophy. A year has since elapsed with no return of the neuritis.

**Deafness.**—The only symptom of congenital lues may show itself in difficulty of hearing and deafness. Apart from the fact that the cause of deafness can be specific disease of the labyrinth, the acoustic nerve may also be affected, as observations of Fournier, Siemerling, and Böttinger show.

**Complicated Cerebrospinal Symptoms.**—Complicated clinical pictures are presented by extensive and multiple processes in the brain and spinal cord. The multiple pathological processes of meningitis, gummata, cerebral and spinal endarteritis, with their consequent areas of softening, correspond in the clinical sphere to headache, dizziness, and vomiting, epileptic attacks, and hemipareses and paralyses, disturbances of co-ordination, anomalies in the behavior of the tendon-reflexes, as well as defects of intelligence.

In general, one can say that the classification of Oppenheim into arteritis, meningitis of the base and convexity, and syphilitic cerebrospinal meningitis, may be applied to congenital as well as acquired lues. It is to be remembered, however, that a combination of the various forms occurs more frequently in the congenital type.

**Hereditary Syphilitic Pseudoparalyses.**—It is well known that Wegner's osteochondritis produces epiphysial paralyses. So long as this does not occur, just so long are there no symptoms. First, when the separation of the epiphysis occurs as a result of the necrotic destruction of the calcification zone and the caseation of the granulation tissue in the medullary spaces, then symptoms in the form of swelling and pain appear in the epiphysial regions, as well as deformities of the bones.

This irritation of the periosteum and swelling of the epiphysial regions occurs most frequently at the upper epiphysis of the humerus.

If the clinical picture of Parrott's pseudoparalysis is well developed, the affected child is unable to move the arms or the legs. All the extremities, or some, or only one,



may be involved. The paralysis appears as a flaccid one. The raised arm or leg falls as if it were paralyzed from an acute anterior poliomyelitis.

In contradistinction to this latter paralysis, however, two things may be noted: first, the change in the electrical reactions of both nerve and muscle are lacking in the paralyzed parts; second, passive motion causes pain and betrays a painful swelling on the end of the bones and a crepitation in the region of the epiphyses, as well as the true nature of the paralysis. In the upper extremities a slight flexion and extension in the fingers, in the lower extremities in the hip-joint, even in the severe cases, is preserved.

The paralysis in such cases is due to two causes: first, the muscle-tendons have no fixed point of insertion since the epiphyses are separated from the diaphyses and slip around here and there, and, second, the movements of the child because of the inflamed periosteum are painful. For this reason the name "pseudoparalysis" seems to be a fitting one.

This affection is a disease of the first weeks of life. Heubner reports a case as occurring at the end of the fifth month, but such exceptions are rare.

There are, however, not always tenderness and pain when the extremities are moved, and sometimes the clinical picture makes the impression of a genuine paralysis.

Reuter expresses the opinion that a real paralysis does exist in these cases, due to nerve compression produced by periosteal specific exostoses and swellings on the bony extremities. Pollack also considers that a true paralysis occurs, but, contrary to Reuter, assumes an affection of the central nervous system.

Scherer regards it as probable that, just as in other chronic infectious diseases, so also here, as a result of the poisoning of the system by a toxin, paresis or paralysis can develop in congenitally syphilitic children, in whom no bony changes can be demonstrated and the central and peripheral nervous system still appear to be intact. The etiology of the paralysis may be attributed to either the toxic effect of

the *Spirochæte pallida* or to other forms of bacterial life circulating in the blood.

**Differential Diagnosis.**—In considering the differential diagnosis of the nervous affections caused by congenital syphilis one must keep constantly in mind that alcohol produces a number of nervous conditions similar to some of those which are found in hereditary lues. Epilepsy, idiocy, and retardation in development of various kinds, as well as general nervousness, hysteria, neurasthenia, and the simple psychoses, are common to both.

**Alcoholism of the Parents.**—How similar in many ways the effect of alcoholism in the parents to that of syphilis is on the offspring, the work of Dr. Sullivan, of Liverpool, shows very clearly. Sullivan began making observations in the large prisons of Liverpool of the children of female alcoholics. After the exclusion of all cases, so far as possible, in which other factors, such as syphilis, tuberculosis, and nervous degeneration, might enter in and confuse the deduction, and after an examination of hundreds of cases of pure alcoholism, he came to the following conclusions:

1. Maternal alcoholism is particularly disastrous for the life and development of the offspring.

2. The influence of maternal alcoholism manifests itself in the great mortality, in the tendency to still-births and premature births, and in the frequency of epilepsy in the living children.

3. The influence of the alcohol is partly that of a poison acting upon the maternal organism and partly from a direct toxic effect upon the embryo.

A fundamental difference exists, however, between the influence of alcohol and syphilis. In syphilis of the parents usually the first-born are the most severely affected, and in the subsequent births there is apt to be a gradual lessening of the toxic effect, while, on the other hand, in alcoholism the reverse is as a rule true. The first-born are normal. Then come abnormal children which survive the period of infancy, then children dying prematurely, then still-births, and finally abortions.

It not infrequently happens that both alcoholism and syphilis exist in the parents, and in such cases it is often difficult to say which factor should receive the most blame.

**Tuberculosis of the Central Nervous System.**—The differential diagnosis between cerebrospinal syphilis and cerebrospinal tuberculosis comes oftener into consideration in children in those cases in which basilar luetic meningitic symptoms develop acutely, and in which congenital syphilitic stigmata have either not been present or were not observed, because cerebrospinal tuberculosis occurs more often in children than in adults.

The combination of tuberculosis and syphilis in the parents is a comparatively frequent one, and the congenitally luetic children, because of lessened resistance, yield easier to tuberculosis.

As the prognosis of hereditary luetic visceral affections in general improves, the later the tertiary processes develop in the internal organs; so also is this true for congenital syphilitic disease of the nervous system. One sees not infrequently cases in which timely antispecific treatment brings the disease to quiescence, yet, as in acquired lues, the possibilities of relapses and intercurrent exacerbations should not be lost sight of.

**Metasyphilitic Diseases of the Nervous System in Congenital Lues. Tabes Dorsalis.**—Cases of actual tabes occur in congenital lues. Dydynski, in a critical study of this subject, states that many of the cases which have been described as tabes dorsalis should have been classified as Friedreich's ataxia. The presence of ataxia and Westphal's symptom does not justify the diagnosis of tabes.

The following cases because of congenital lues were diagnosed as tabes:

A girl, thirteen years old, was referred to me on account of beginning double optic atrophy. The father had a chancre before his marriage and received antispecific treatment. Previous to the birth of this child the mother had aborted a number of times. The child had, in addition to the optic atrophy, double mydriasis with loss of the pupil-reflexes, slight sensory disturbances for pain in the lower

extremities, the patellar reflexes were only obtainable by reinforcement, and there was a slight ataxia in the lower extremities. There were no evidences of tertiary lues.

A laborer, thirty-two years old, was married six years ago. He stated that before his marriage he had never had intercourse. His wife stated also that before her marriage she was a virgin. In the six years of their marriage three children were born, all of whom were weak, but at the time of my examination presented no traces of hereditary lues. One year ago, without any apparent cause, the patient was taken sick with lightning pains in the lower limbs, weakness of the bladder, paræsthesias in the toes and feet, and unsteadiness in standing and walking. The patient was always temperate, denied excesses in venery, and had never been subject to severe exposure.

The objective examination revealed anisocoria of the pupils, loss of the pupil light reaction with accommodation retained, absence of the patellar reflexes, Romberg's symptom, hypalgesia and slowness in pain conduction. On the left leg there was found an extensive scar. The patient stated that when nine years old he had been operated on, in the Altona City Hospital, for a bone disease. An examination of the records there showed that his bone affection had at that time been finally diagnosed as syphilitic and was healed with mercury and iodid administered internally. The record also stated that the patient's father had syphilis.

At the present time many cases of infantile and juvenile tabes as a consequence of congenital syphilis have been reported, to the correct diagnosis of which no objection can be made. Halban and Dydynski direct attention to the frequent and early appearance of optic atrophy and partial bladder paralysis, as well as to the rareness of severe ataxia in juvenile tabes. Otherwise, all the symptoms of tabes of the adult, including the crises and trophic disturbances, occur in the congenital form.

In cases of infantile and juvenile tabes the frequency of occurrence in the anamnesis of postsyphilitic disease in the family is worthy of mention.



**Pseudotabes Syphilitica.**—As one must be on his guard not to overlook an extra-uterine acquired lues, so one must not diagnose a non-tabetic ataxia in childhood as a tabes.

It is to be remembered that individual tabetic symptoms may be exhibited by atypical genuine specific disease of the posterior columns.

**Dementia Paralytica.**—Dementia paralytica also occurs as a result of congenital lues, and recently the cases appearing in the literature have been more frequent since our attention has been more sharply directed to this condition by several pertinent observations.

A case of my own is especially interesting, since here the dementia paralytica was the only expression of hereditary syphilis, in a boy twelve years old, and also because the luetic history was rather unusual.

The father absolutely denied ever having had syphilis and a painstaking examination revealed no past or present evidences of it. The mother stated that while taking care of a luetic patient she contracted the disease extragenitally. She married several years later, after having taken anti-specific treatment.

Her first pregnancy terminated with the birth of a dead fœtus at the sixth month. The second child was born a month too early, developed in the fourth month of life a rash, and died in the beginning of the second year. This boy was the third child, who likewise was born a month too early. A fourth child was born at full term and since his fourth year has been afflicted with paroxysmal hæmoglobinuria. Finally a fifth child was born at full term as a normal baby, and this child remained healthy until sixteen months old, when it died with vomiting and diarrhœa.

This boy remained apparently well until in his eleventh year, when a progressive and rapid-developing dementia set in, which was accompanied by an articulatory speech disturbance, tremor of the extremities, paresis of the mimetic innervation, increase of the tendon-reflexes, mydriasis, and loss of the pupil-reflexes.

In the cases reported in the literature syphilis of the parents has not always been demonstrated. In some of the

cases a specific infection was found to have occurred in infancy and childhood. In others there was a combination of several etiological factors, such as severe psychopathic inheritance, alcoholism of one or both parents, and head injuries.

It can be said at the present time that both tabes and dementia paralytica as a consequence of hereditary lues are found in all stations of life. The following case is a classical one of juvenile paresis:

A girl, fourteen years old, presented a typical picture of dementia paralytica, which began when she was eight years old. The father, during his courting period, infected his bride through kissing with a lip chancre. He later died with general paresis. The mother presents at the present time the clinical picture of an abortive tabes. The girl died, and the autopsy, as well as the microscopical examination, showed the pathology of paresis along with a typical Heubner's endarteritis.

The course of infantile paresis is, on the average, a longer one than it is in adults. Alzheimer places the average duration as four and a half years. In the majority of the cases inferior mental endowment dated back to infancy; also a simple progressive dementia was the type most often presented and the depressive and maniacal states so often seen in a classical paresis were lacking. Severe paralysis is particularly inclined to develop early and paralytic attacks are more liable to occur in the beginning of the disease. Tabetic symptoms are also more frequently found.

The pathology does not differ from the pathology in the adult form. The combination of the typical findings in paresis along with Heubner's endarteritis is a frequent one.

In addition to tabes and paresis other clinical pictures are presented in children which must be regarded as meta- or postsyphilitic affections.

**Homén's Familiar Disease (Idiocy with Spastic Paralysis).—**Homén, in 1892, described a disease appearing in three children of the same family, which was evidently due to congenital lues. This affection begins usually between the ages of twelve and twenty, with symptoms of dizziness,

heaviness in the head, and disturbances of the general health; then the intelligence and memory begin to fail. Along with vague and diffuse pains in the limbs, the gait becomes uncertain and the speech difficult. The loss of the intelligence progresses to idiocy. The speech disturbance resembles in nature to the last more that of a lack of initiative than anything else. Spastic symptoms appear in the lower limbs and then in the upper, progressing to well-developed contractures. Somatic symptoms on the part of the pupils or in the form of anæsthesias or pareses were absent. There existed in all three children a certain degree of infantilismus.

The pathology of all three cases was similar.

Macroscopically there were a thickening of the cranium, the dura and pia mater, atrophy of the brain in its entirety, sclerosis of the cerebral vessels, areas of softening, and cirrhosis of the liver. Microscopically there were absorption of the tangential fibres, atrophic changes in the large pyramidal cells, thickening of the neurologia, and arteriosclerotic and hyaline changes in all the cerebral vessels. Homén regarded the changes in the vessels as the most essential and primary part of the process.

#### **Spastic Spinal Paresis with and without Cerebral Symptoms.**

—In 1892 Friedmann published two cases of relapsing, apparently luetic so-called spinal paralysis occurring in childhood. These cases occurred in two boys, ten and fifteen years old, respectively. In the first case, after two attacks, under antispecific therapy complete recovery took place both times. In the second case, also recovery after the first attack occurred, but after the second the gait was only improved.

Upon the basis of these observations, which were simply clinical ones, Friedmann concluded that there is a typical form of spastic paraplegia in children which is to be distinguished from the so-called congenital spastic paraplegia; also that this form is due to congenital lues and clinically is defined by its tendency to complete recovery, relapses, and the absence of brain-symptoms. Friedmann regards this type of spinal paralysis in children as similar to the

syphilitic spinal paralysis of Erb in adults. Hoffman, in 1894, also reported a similar case to that of Homén's.

The following case came under my observation:

A seven-year-old girl was born at the seventh month and with great difficulty made to live. She remained feeble, learned to talk late, teethed late and badly, and became clean in her habits later in life than usual. She never learned to walk, but had a spastic paresis in the lower extremities. Treatment with plaster-of-Paris bandages caused no improvement.

Her father, three years before his marriage, had a hard chancre, which was healed by administration of mercury and iodid.

The girl had the appearance of an imbecile. There was a left convergent strabismus, but otherwise no oculopupillary anomalies. The cranium was slightly microcephalic, the teeth much decayed and abnormal. The lower extremities were spastic and paretic. Disturbances of sensation and of the sphincters were absent. The child was unable to stand or walk. The speech was normal. Syphilitic stigmata were lacking.

**Sachs's Amaurotic Idiocy.**—The interesting work of Sachs should be mentioned here. He has described a clinical syndrome which likewise consisted in dementia and spastic paralysis of the extremities. In addition to these symptoms there was also a failure in power of vision, which gradually progressed to complete blindness. This affection appeared in several members of the same family. The pathology was that of a disease of the cells and medullary fibres of the brain cortex, corresponding to that of retarded development. Sachs did not attribute any relationship between these cases and syphilis. There was no suspicion of syphilis in the history and there were no changes in the blood-vessels or inflammatory symptoms of that nature to be found. He assigns this affection to that category in which an inherited tendency or family tendency is the last cause of the anomalies in the nervous system, which depend either upon intermarriages or a trauma to the mother during pregnancy.



Since Sachs's studies concerning this affection many cases of a similar nature have been reported in the literature without adding anything clinically new to the subject.

Concerning the differential diagnosis between amaurotic idiocy and congenital luetic affections, sometimes considerable difficulty may exist. In juvenile paresis, beginning with optic atrophy the four reactions will aid in distinguishing between the two conditions, but other affections of the brain with changes in the eye backgrounds and idiocy of congenital luetic origin, if the four reactions are negative, may be extremely difficult to differentiate. The difficulty may be still greater if we consider with Spielmeyer that lues may possibly play some part in the origin of amaurotic idiocy.

**Disseminated Sclerosis.**—Jacobson has discovered a case of multiple sclerosis in hereditary lues in a child which developed intra-uterine an interstitial keratitis and at the autopsy there were found hepatitis, perihepatitis, hyperplasia of the spleen, perisplenitis, and parenchymatous nephritis. There were also found in the brain, both in the gray and white matter, numerous gray indurated spots which varied in size from a mustard-seed to a hazel-nut, and which were evidently of a different character from the sclerotic plaques found in the idiopathic multiple sclerosis. There was besides an extensive leptomeningitis.

The clinical course was a different one from that of the ordinary multiple sclerosis. Beginning with headache and fever, a left hemiplegia and anisocoria developed, which, under the administration of potassium iodid, disappeared. There was present also an athetotic-like movement in the hands and fingers on both sides. There then appeared suddenly some general cerebral symptoms, from which the boy died.

In a case published by Buchholz, along with severe psychic disturbances there were intentional tremor, increase of the tendon-reflexes, motor weakness and spasticity of the lower extremities, speech disturbances not of the scanning kind, anomalies of the pupils, optic atrophy, but no nystagmus.

The autopsy revealed multiple gummata, syphilitic dis-

ease of the blood-vessels, cavity-like areas in the substance of the brain, thickening of the cerebral and spinal leptomeninges, as well as a diffuse increase of the supporting substance in the spinal cord. Clinically and pathologically the case was a very different one from multiple sclerosis.

**Symptoms of Friedreich's Ataxia.**—In rare cases there has been observed a symptom-complex in congenital lues which resembles the one presented in Friedreich's ataxia. Oppenheim reports cases in which he was unable to make a differentiation with certainty. Yet, in the majority of these cases, the appearance of spastic symptoms, convulsions, and paralysis of the eye-muscles serves to differentiate the true condition.

Bayet reports the history of a family in which four children, in age from nine to seventeen, presented the picture of a Friedreich's ataxia. The mother had aborted numerous times and positive symptoms of syphilis were found in the children. Bayet assumes that the syphilis had caused a cessation in the development of the cord.

**Congenital Syphilis in the Third Generation.**—In conclusion, some consideration should be given to the influence of syphilis on the third generation, whether or not in the offspring of congenitally syphilitic parents, stigmata of congenital lues are demonstrable, especially in the nervous system.

Numerous observers have contributed pertinent experiences on this subject.

Mensinger reports the following case:

The grandfather had contracted lues before his marriage. In all of his six children, either at or soon after their birth, symptoms of congenital lues were manifested. One of these children, the next to the oldest daughter, at the age of twenty married a man who, after an examination by a physician, was pronounced free from syphilis. Of the five children born from this marriage the first wasluetie, the second healthy, the third became sick with meningitis when one year old, which was cured by the giving of potassium iodid, the fourth and fifth children were also syphilitic and infected their wet-nurse.

Barthélemy cites three interesting cases. One was an idiot born of a congenitally luetic mother, a second was an epileptic whose father died with general paresis and whose grandfather on the father's side had syphilis. The third was a woman who, at the age of forty-three, developed a spastic spinal paralysis. Both of the parents of this woman were syphilitic. The woman herself had a mentally backward daughter, with hydrocephalus, asymmetrical head, and strabismus.

The largest material, however, comes from A. Fournier, who has collected from the literature 45 cases, in 18 of which the proof of inherited syphilis was certain. Fournier further presents 46 marriages of congenital luetics from his own experience. In these 46 marriages there occurred 143 pregnancies and these ended in 43 cases in abortions, 39 cases with either still-born children or children dying soon after birth, and in 63 cases with living children. In this entire material there were found dystrophies, eye defects, tumors of the brain, rachitis, general retardation of physical development, infantilismus, mental and idiotic dystrophies, epilepsy, and hysteria, nervous convulsions, neoplasms of the heart, closure of the urethra, anomalies of the fingers and toes, atrophy of the tongue, congenital extremity amputations, and neoplasms on the palate, ears, and lips.

All of these observations show how far-reaching the influence of inherited lues is and also serve to emphasize the importance of anamnestic researches and inquiries where inhibited and deficient development occurs in the nervous system.

The supposition that lues in the third generations will be more frequently discovered by means of the more recent methods of examination is confirmed by the following observation:

A fifteen-year-old girl was brought to me on account of general nervousness and physical and mental asthenia. She was unable to keep up in her school work, was easily exhausted with either mental or physical effort, was unable to sleep, and habitually tired. She was a seven months' child. The father was healthy, but, because of his occupation, ner-

vous. The mother was also nervous but otherwise healthy. The patient herself when six years old had a severe attack of measles and later two attacks of pneumonia. The girl was pale, strikingly sober for her age; fairly well nourished; somatic anomalies, either physical or neurological, were apparent; stigmata of degeneration were absent. A general tonic treatment was only partially successful. The father denied lues.

The patient was the second child. The first was likewise a seven months' baby; at birth was very weak; now abnormally irritable and subject to outbreaks of anger. The third child was scrofulous; the fourth apparently healthy.

The Wassermann reaction in the patient was + +. The luetin reaction was moderately strong positive; a marked infiltration but no pus formation.

From a colleague I ascertained that the mother of the patient was treated by him during her first pregnancy for symptoms of lues. The husband was at that time examined by him but no evidence of syphilis was found, with a negative anamnesis. The father of his patient died with paresis. A Wassermann taken by me, of both parents, resulted in a negative for the father and a positive for the mother. Other stigmata of lues in both parents were lacking.



## XVII

### CONCERNING THE BEHAVIOR OF THE WASSERMANN REACTION IN THE BLOOD AND SPINAL FLUID, ALSO PLEOCYTOSIS AND THE INCREASE OF GLOBULIN (PHASE I) IN SYPHILOGENETIC DISEASES OF THE NERVOUS SYSTEM.

**Introduction.**—The results of investigations as to (*a*) lymphocytes, (*b*) increase of albumin in the cerebrospinal fluid, and (*c*) the existence of the Wassermann reaction (W. R.) in the blood, have in recent years been used by neurologists of all countries for the differential diagnosis between syphilitic affections and other diseases of the central nervous system. These attempts have greatly advanced our knowledge. The statements of the French (particularly of Vidal, Ravant, and Sicard) have been generally confirmed. The investigation as to the increase of albumin in the cerebrospinal fluid, introduced by Nissl, has been made easy by the so-called “Phase I” reaction, introduced by myself and Apelt, and tested by us on a large number of patients. I first published this reaction four years ago, and its value has since been confirmed by many authors, so that it may now be regarded as generally accepted in the diagnostic methods of neurology.

**The Wassermann Reaction Not a Specific.**—The W. R. in the blood can no longer be regarded as specific, but only as characteristic of syphilis, for it has been stated by many authors that it also occurs in a certain percentage of some tropical diseases, such as leprosy, malaria, and in recent cases of scarlatina.

**Examination of Cerebrospinal Fluid.**—The examination of the cerebrospinal fluid for the W. R. has become of greater importance since Hauptmann and Hoessli in my clinic introduced the use of increasing quantities of the cerebrospinal fluid. I have also tested and determined the value of

this method on the material in my ward. It has been shown that the Wassermann reaction in the spinal fluid, in larger quantities of the fluid up to 1 c.c., occurs in syphilogenetic diseases of the nervous system. On the other hand, this question has reached a certain finality in so far that any one who can use the "four reactions" and interpret them correctly may, by their aid, clearly diagnose cases which are clinically doubtful. During the last four years I have occupied myself almost uninterruptedly with these reactions, as they from time to time appeared in the literature, and have tried to solve the questions, as they presented themselves, from the abundant material at my disposal in hospital and private practice. I especially tried to ascertain how far the result of the "four reactions" would admit of definite conclusions.

Of the numerous comprehensive studies which deal with the examination of the spinal fluid as a diagnostic agent, and which confirm my conclusions, I will mention only those of Rehm, W. Holzmann, Eichelberg, and Stertz.

**The Technique of Lumbar Puncture.**—The technique of lumbar puncture is comparatively simple, and is as follows: In the middle of a line connecting the crests of iliac bones a puncture is made between the laminæ of the third and fourth lumbar vertebræ by means of a cannula and trocar. It is best to let the patient lie on his side during the operation. I personally prefer to let him lie on his right side. The pressure of the fluid as it escapes is measured by a vertical glass tube, graduated in mm. The pressure is in normal adults about 130 mm. A quantity of 5 c.c. of fluid is sufficient for the purpose of testing the reactions, for one should take as little as possible to avoid disagreeable complications, which, however, will occur now and then in spite of all precautions. These occasional disagreeable consequences consist of headache, nausea, and vomiting. The quieter the patient is kept after the lumbar puncture, the less will be the liability of trouble arising from this trifling operation.

**Dangers and Unpleasant After-effects of Lumbar Puncture.**—Experience goes to show that paralytics and tabetics are in

almost all cases free from subsequent troubles. On the other hand, nervous and hysterical patients, as well as healthy persons, often experience for one or more days disagreeable symptoms. The withdrawal of spinal fluid in cases of cerebral tumor is by no means free from danger. Thirty fatal cases have been reported in the literature. Personally I have seen four cases of sudden death in patients with cerebral tumor following the lumbar puncture. In about 3000 cases of lumbar puncture in patients with other diseases I have never observed any permanent injurious consequences. As a precaution it is advisable, for twenty-four hours after the operation, to allow the patient to lie quietly in bed, on his back, with head low, and not allow him to get up during this time, even for the performance of his natural functions. If one omits these precautions, most disagreeable consequences may arise, for the patient may suffer for days, and even weeks, from headache, giddiness, and nausea. To perform the puncture in the consultation room (as has been done) is absolutely to be condemned, because the doctor may be held liable for any possible disagreeable results. I have myself experienced this in a case, to my sorrow.

**The Presence of Blood in the Cerebrospinal Fluid.**—The cerebrospinal fluid usually flows out from the needle or cannula as clear as water, but it sometimes happens, in spite of the most skilful technique, that a small vein is punctured and some blood mixes with the fluid. The presence of blood may also be observed in the spinal fluid in subdural hemorrhage, fracture of the skull, cerebral apoplexy, etc. It is comparatively easy to differentiate between a recent and an old hemorrhage. In recent hemorrhage, after centrifuging, the spinal fluid becomes as clear as water. Where the hemorrhage has occurred some time before, the spinal fluid presents a light-yellow appearance, indicating the presence of hæmoglobin.

A mistake as to whether the blood is caused by the lumbar puncture, or comes from a subdural hemorrhage, is scarcely likely to occur, since one can distinguish between

the blood produced by the puncture and other recent hemorrhages from the clinical symptoms present previous to the puncture.

Both Klieneberger and I have been able to demonstrate a yellowish tinge (xanthochromia), as well as either the presence or absence of a moderate degree of pleocytosis in compression of the spinal cord. This behavior of the spinal fluid also occurs in intramedullary tumors and intramedullary syphilis, as Raven and I have shown from material in my department.

It goes without saying that such fluid is useless for an estimation of the increase of either albumin or white cells, but a slight admixture of blood does not interfere with the W. R.

**Spinal Pressure.**—The measurement of the spinal pressure, which we take in almost all cases according to Quinke's method, in our opinion, has no value in the diagnosis of syphilis of the central nervous system. The normal spinal pressure in lying varies between 100–150 mm. water; in pathological conditions usually from 150–300 mm. water. The pressure may rise, however, to 800 mm. water. The spinal pressure in both lues vascular and lues parenchymatosa is generally increased; since the pressure in other organic nervous disease of non-specific origin, as tumor, abscess, hydrocephalus, encephalitis, encephalomalacia, etc., is also increased, its diagnostic value in differentiating between specific and non-specific organic nervous disease is unimportant.

The freezing point determination of the spinal fluid has also no differential diagnostic value.

In regard to the resistance of the spinal fluid to an electric current, it may be said in general that the resistance decreases as the soluble substance in the spinal fluid decreases.

**Phosphoric Acid.**—Donath has discovered a great variation in the amount of phosphoric acid in the spinal fluid of paretics, and has suggested, therefore, that phosphoric acid, as a decomposition product of lecithin, furnishes an indicator of diagnostic and prognostic value. On the other hand,



Apelt and Schumm, in my clinic at Eppendorf, discovered no more variation than may normally occur. The largest quantity of phosphoric acid was found by them in a case in which no extensive destruction of nervous tissue was possible. The significance of phosphoric acid in the spinal fluid has not yet been determined.

**The Globulin Test. Phase I.**—The simplest method of testing the cerebrospinal fluid for albuminous bodies is to search for an increase of globulin—the so-called “Phase I” reaction, introduced by myself and Apelt. For this purpose there is added to a hot saturated solution of sulphate of ammonium which has been permitted to cool an equal quantity of fluid; 1 c.c. of each is quite sufficient. It is advisable to pour one liquid gently on top of the other; if the globulins are increased, there occurs a more or less distinct gray ring at the plane of contact. After this preliminary observation the mixture is well shaken and the result may be read off within three minutes. If it is distinctly opalescent or cloudy, we call it a positive “Phase I” reaction.

**The Fuchs-Rosenthal Method of Counting the Lymphocytes.**—For the examination of the cerebrospinal fluid as to an increase of cells, we have found the Fuchs-Rosenthal counting-chamber best. It is somewhat larger than the one generally used to count the red and white blood corpuscles. The counting is performed as follows: The staining fluid (0.1 G. methyl violet, 2.0 G. glacial acetic, 50 G. distilled water) is drawn up by the pipette, in general use for counting the white blood-cells, to point I, and then further filled with the liquor to point XI. After shaking the pipette for five minutes, a drop of the mixture is put on the counting-chamber. One counts all the lymphocytes and leucocytes in all the squares, and divides the number ascertained by three. Our experience has taught us that one may regard from 0 to 5 cells per c.mm. as normal, 6 to 10 as borderland, while more than 10 cells per c.mm. constitute pathological increase.

**The Goldsol Reaction.**—The principle of this reaction depends upon the precipitation of gold cut out of the colloidal gold solution caused by the changing ratios of protein con-

tent. Lange was able to determine this experimentally by tests with nutrose and albumose. In these experiments he succeeded in obtaining the Goldsol maximum of reaction or precipitation at definite points in the dilution series, the albumen content remaining the same. He also showed that the reaction maximum in the dilution series with the spinal fluid of different organic nervous diseases was not the same. Eiche, after a large experience in the examination of spinal fluids in different diseases, by means of this reaction, thought he was able not only to differentiate specific from non-specific organic nervous diseases but also distinguish between the various types of syphilitic nervous disease.

The proper color of the Goldsol solution in making this reaction is exceedingly important. The solution should be a port-wine red, perfectly transparent and free from any tinge of purple. The needle used in making the spinal puncture should be washed in alcohol, ether, and then rinsed in double distilled water. The tubes in which the dilutions are made should be filled first with strong nitric acid, then washed with alcohol, ether and double distilled water. The pipettes also should be treated in the same manner; a different pipette should be used for each dilution. The dilutions are made as follows: 1.8 c.c. of a 0.4 salt solution with 0.2 c.c. of the spinal fluid to be examined are put into the first tube; this is thoroughly shaken, as must also be done with each subsequent tube; 1 c.c. is then taken out of this tube and put into the next one which had previously been filled as were all the other tubes in the series with 1 c.c. of the 0.4 salt solution. After shaking this second tube well, 1 c.c. is taken from it and put into the third tube; the other dilutions are made in the same manner, the extra c.c. in the tenth tube being thrown away. The tubes are then all filled with 5 c.c. of the Goldsol solution and again well shaken.

The dilutions in the tubes start with  $1/10$  in the first tube and extend to  $1/5120$  in the tenth tube.

The color scale produced by the varying precipitation is expressed by port-wine red, the normal solution color, bluish-red, violet, blue, bluish water and water.

A change in the color of the tubes may be noticed within

a few minutes after adding the Goldsol solution, but a final reading of the reaction should not be made for some hours, usually either twelve or twenty-four. The reaction may be represented diagrammatically by expressing the dilution numbers on the abscissa and the color numbers on the ordinates. The following curve typical for paresis will illustrate this graphically:

It is read off and expressed numerically thus: 5-5-5-5-5-32100. The first five tubes are the color of water, the sixth blue, the seventh violet, the eighth bluish-red, while the ninth and tenth remain unchanged. This type of reaction has sometimes been called the "paretic curve." In the so-called luetic zone (tabes and cerebrospinal meningitis), the greatest change in color occurs in the  $1/40$  and  $1/80$  dilutions, these dilutions in typical cases showing blue or bluish water. In the non-specific meningitic zone the greatest change in color is supposed to occur in the dilution  $1/160$ ,  $1/320$ ,  $1/640$ . Opinions of different authorities differ greatly as to the reliability of this test. Some few consider it the most reliable and delicate of all the reactions for the differential diagnosis of syphilitic nervous disease. The consensus of opinion at present, however, is that the reaction requires the corroboration of the other reactions and by itself too much confidence should not be placed in it. Its most constant finding occurs in paresis. In tubercular meningitis in our experience in a limited number of cases (six) the greatest color change has occurred regularly in the zone  $1/160$ ,  $1/640$ .

#### Technique of Obtaining Blood for the Wassermann Reaction.

—The technique of obtaining the blood for the Wassermann reaction is very simple. A "Bier" ligature is tied around the upper arm so firmly that the veins of the forearm fill tensely, but the pulse at the wrist is still palpable. The cannula or needle is then introduced from above, so that the venous blood may escape in its natural direction, and 5 to 10 c.c. of blood are taken. The blood is then thoroughly stirred with a glass rod to facilitate the separation of the serum, and this stirring is repeated at intervals of half an hour until the process is complete. It is then preserved on ice until it is to be used for the W. R.

**The Wassermann Reaction.**—I do not intend to describe the technique of the W. R. in detail. It must be performed in large institutions or in private special institutions on account of the serological training and the number of controls required, which are possible only in such places. But I consider it necessary to shortly recall the history and character of the reaction. Wassermann started from the Bordet-Gengou doctrine of the complement-deviation by known micro-organisms, and tried to apply this phenomenon to diseases the organism of which was not as yet known, or at any rate had not been grown artificially. He used, in the place of pure cultures of micro-organisms, organs which either may or may not with certainty contain the organism of the disease in question; for instance, in syphilis, the liver of a luetic fœtus plentifully pervaded with spirochætes. After having completed his preliminary investigations, he published, together with Neisser and Bruck, the well-known reaction by means of which one can prove that an individual, at some time during his life, has been infected with syphilis. The original method, after the test of time, has proved best, although several authors have proposed modifications.

From the liver of a luetic fœtus a watery extract is prepared, and if this is added to the serum of a syphilitic individual it is able to deflect the complement from the hæmolytic serum (consisting of sheep's blood-corpuscles and guinea-pig serum as "complement," and of the serum of a rabbit previously treated with sheep's blood as "amboceptor"), and thus to impede the combination of the system and the resultant hæmolysis.

A glance at the following will enable one to better understand the reaction.

**Wassermann-Neisser-Bruck Syphilis-Reaction-Components.**—(1) Sheep's blood-corpuscles, (2) amboceptor, (3) complement-hæmolytic system, (4) antigen (extract from organ), (5) liquid to be examined (serum or cerebrospinal fluid) containing antibodies (?).

These components are prepared as follows: (1) Sheep's blood-corpuscles are freed from all serum elements by cen-



trifugation with sodium chloride, (2) rabbit serum previously treated with sheep's blood, (3) freshly obtained normal guinea-pig serum, (4) watery or alcoholic extract of a hereditary-luetic liver (or of a normal heart), (5) serum freshly taken or kept sterile by preservation on ice, and obtained by simple separation from the blood to be examined.

**Principle of the Reaction.**—Two interactions ("ring") may occur between these components:

(a) Sheep's blood-corpuscles are, in the presence of complement, dissolved by the amboceptor (hæmolytic system), or (b) a second interaction occurs between antigen, antibody, and complement.

If antibodies exist in the serum to be examined they attract to themselves, in conjunction with the antigen, the complement, so that the first interaction cannot take place from want of complement, and consequently the blood-corpuscles cannot be dissolved.

1 and 2 and 3—the first interaction.

3 and 4 and 5 (?)—the second interaction.

**POSITIVE REACTION.**—1 and 2 (3 participates in the second interaction; the first interaction does not occur; the blood-corpuscles remain undissolved); 3 and 4 and 5—the second interaction.

**NEGATIVE REACTION.**—1 and 2 and 3—the first interaction (hæmolysis). 3 participates in the first interaction, from the second interaction only 4 is present, while 5 (antibodies) are not present in the non-luetic serum.

**Technique of the Reaction.**—The serum to be examined is placed for half an hour in the incubator at 55° C. (131° F.) to destroy its own complement. Serum (antibodies?), antigen, and complement are mixed and placed for one hour in the incubator at 37° C. (98.6° F.), so that the second interaction may occur. Then, after the addition of amboceptor and blood-corpuscles, the mixture is again put for two hours in the incubator, so that if the second interaction (from want of antibodies) has not occurred (the complement thus not having been used up) the first interaction may occur (hæmolysis).

The nature and significance of the fixing elements contained in the serum of syphilitics is not yet clearly understood, and this is also the case in regard to the active elements in the extract of the luetic liver. Wassermann, Neisser, and Bruck originally assumed that we have before us a specific antibody-reaction. Bruck still adheres to this view, though objections have been raised to it as follows:

(a) A reaction of equal effect has been obtained when the extract was made from normal organs instead of from luetic liver. The luetic liver extract could also be replaced by other substances which normally exist in the organism, and which can be manufactured chemically pure.

(b) As I mentioned in the introduction, it has been proved that the W. R. cannot be regarded as absolutely specific in the clinical sense. It has been occasionally demonstrated in leprosy, malaria, frambœsia, recurrent fever, and, perhaps, also in marked cachexia associated with tuberculosis, diabetes, etc. It has recently been asserted that the serum of plague cases also shows positive W. R. The occurrence of this reaction, however, is not constant in these diseases, and depends greatly on the quality of the extract. There exist extracts which are excellent to prove a previous syphilitic infection, but which nevertheless yield no positive reaction with scarlatina serum, while others react beautifully both with the serum from scarlatina and from syphilitic patients. In scarlatina—the only disease which in our latitudes (Germany) need be considered in the differential diagnosis—the positive reaction further depends on the disease being of recent date, for after four weeks at the most the serum of a scarlatina patient loses the power of diverting the complement of the hæmolytic system. Taking all the above circumstances into consideration, it is hardly admissible to speak of the reaction as specific in the clinical sense; it can only be described as characteristic. It is, however, not intended by this statement to restrict the practical usefulness of the W. R.

**The Luetic Reaction In Syphilis.**—The first attempt to diagnose syphilis by means of a cutaneous reaction was made by Meirowsky and Tedeski. Many subsequent attempts were

made by various observers with indifferent results. In 1911 Noguchi employed a pure extract of spirochætes and named it luetin.

TECHNIQUE.—An exact technique of inoculation is absolutely essential to obtain a specific reaction. The needle should penetrate only the superficial layers of the skin, about 1 cm. in length, care being taken to avoid hemorrhage, so when the luetin is injected, a white wheal is formed of the upper layers of the skin. In the first twenty-four hours after the inoculation there develops a moderate degree of redness, combined occasionally with a slight infiltration which is non-specific in character. In negative cases this non-specific reaction usually entirely disappears in forty-eight hours. In positive cases within forty-eight hours there develops at the site of the injection a hard, indurated, and sharply circumscribed papule from 3 to 5 mm. in width. This papule increases in size for several days and then heals without scar formation. In severe reactions between the third and fifth days the papule changes into a pustule, which later discharges and heals with a scab formation. If a positive reaction appears after a latent period of eight days, the reaction is spoken of as a "delayed reaction." A reaction cannot be regarded as absolutely negative until a period of from eight to fourteen days of observation has elapsed.

In differentiating the reaction there is to be considered:

First. The initial stage, a circumscribed erysipelas-like redness in the first twenty-four hours.

Second. Negative reaction = 0. If the redness of the initial stage has disappeared and if at the site of the injection there is not the slightest infiltration either to see or feel.

Third. (a) Weak reaction = +. If at the site of the injection one is able to feel an infiltration but not to see it.

(b) Strong reaction = + +. If after twenty-four hours a hard red papule sometimes surrounded with a small reddish areola develops, increases in size up to the third day, remains about ten days and then slowly disappears.

(c) The severe type of reaction = + + +. If between the third and fifth days a pustule with watery contents develops out of the papule.

In order to avoid a false reaction it is important that the patient has not taken potassium iodid or a bromide preparation for a number of weeks before the inoculation and does not take it for several weeks afterwards. Typical specific appearing reactions will often occur in non-specific persons who either are taking or have recently taken such medication. Our results with the luetin reaction, according to the above classification, were as follows: In 30 cases where lues could absolutely be excluded, the luetin reaction was negative. In primary and secondary lues in contradistinction to the Wassermann reaction, the luetin reaction was usually negative, if not made in a late period of the secondary stage. In *tabes dorsalis* and *paresis*, the luetin reaction was positive in all the cases (27) and in the strong form = + +. In *lues cerebri* the reaction was likewise strong + + to + + + in all the cases (6). The strongest positive reaction occurred in gummatous (3 cases) and congenital (9 cases) specific disease as well as lues in the patent period (15 cases). The reaction in these cases was always + + +. It is interesting to note in 20 cases of neuro- and psychopathies the luetin reaction was + to + + as an evidence of specific embryonal injury where both the personal history and the Wassermann reaction was negative but where indications of lues were discovered in the ascendants. It is quite probable that the field of congenital syphilis will be considerably enlarged by means of the luetin reaction. Perhaps some diseases in which the etiology is not clear may be definitely recognized as specific in origin by the routine use of this reaction.

**EXPLANATION OF THE REACTION.**—The skin reaction is regarded as purely toxin. It is, according to Klausner, the expression of a changed and intensified reaction of the syphilitic organism, a type of antibody-antigen reaction, a genuine skin allergy, like the tubercular reaction. Since, according to Benedek, the tertiary syphilitic changes are closely related to anaphylactic processes, it is easy to understand why a reaction process and its intensity, founded upon hypersensitiveness in the late stages of the disease, is much increased.

**THE SKIN REACTION AND THE WASSERMANN REACTION.**—Like the most observers we found in our experience the



Wassermann reaction positive in the great majority of the primary and secondary cases in contradistinction to the luetin reaction, but in the tertiary state the luetin was the most constant. A provocative character of the skin reaction, that is the bringing forth of a positive Wassermann which before the inoculation was negative, contrary to some observers we were unable to find.

**The Significance of Lymphocytosis.**—What does the increase of the lymphocytes (pleocytosis) in the cerebrospinal fluid prove? Pleocytosis occurs in about 95 per cent. of syphilitic and metasyphilitic affections of the central nervous system, but may also be noted in other organic non-syphilitic nervous diseases, though much less frequently, nearly always in a low degree, and only quite exceptionally with great intensity. In genuine syphilitic, and still more so in metasyphilitic, diseases (general paralysis and tabes) of the nervous system, the lymphocytosis is intense, or even very intense (50 to 300, even to 600 and 900 lymphocytes in the field of vision).

One should not neglect to mention that there are cases of tabes in which lymphocytosis is absent, and especially is this apt to occur in old stationary cases.

Of great importance is the fact first stated by Merzbacher, afterwards by Schoenborn and by Apelt, that individuals who have once been infected by syphilis may show a weak or moderate lymphocytosis even in the absence of any clinical symptoms of organic nervous disease. According to our statistics, it occurs in about 30 to 40 per cent. of the cases. We may well conclude, therefore, that the finding of lymphocytosis, especially if it is of great intensity, must point with great or even very great probability to the existence of a syphilitic organic nervous disease, but it does not prove it with certainty.

Concerning the kind of cells distinction was formerly made, and in fact still is, between the lymphocytes and leucocytes. The old technique does not permit us to differentiate closely the individual cells from one another. Since the devising of a new technique by Alzheimer the different types of cells may be recognized. Alzheimer, and later

O. Rehm, were able to differentiate small and large lymphocytes, nucleated leucocytes, eosinophile cells, plasma and lattice-like cells, and also macrophage cells, while Szecsi was able to differentiate neutrophile and eosinophile leucocytes, microlymphocytes and endothelial and plasma cells. It is at the present time doubtful whether the recognition of these cell differences will ever become of any practical importance in the diagnosis of syphilogenetic diseases. The attempt to recognize in the spinal fluid a characteristic cell-picture for the development of a paresis, or to foretell the time of progression of a syphilogenetic affection, has not as yet been crowned with success.

**The Origin of the Cellular Elements.**—We do not know as yet the origin of these cells. There are two theories which stand in direct antithesis to one another to explain this. Nissl and Merzbacher believe that the cells transmigrate from the blood, while Fischer and Szecsi, in support of the Unna-Oppenheim view, consider them of histological origin, that is, that the connective tissue of the leptomeninges is responsible for their appearance in the spinal fluid. This much, however, is sure: that pleocytosis is the result of an inflammatory irritative condition in the leptomeninges. It has been demonstrated by such observers as Nissl, Ranke, Fischer, O. Rehm, and others, by the microscopical examination of the infiltrations in the leptomeninges, that similar cellular elements are found there.

Whether these cellular elements which resemble our lymphocytes and the so-called plasma cells transude through the ependyma into the spinal fluid independently or occur there as cast off material, a part of the chronic destructive processes of paresis and tabes, the future will doubtless determine. The degree of lymphocytosis, however, does not seem to bear any relationship either to the acuteness or chronicity, the benignancy or malignity of the clinical course (tabes, paresis, lues cerebrospinalis). Almost all observers agree on this point and Kafka, from a large experience at Friedrichsburg, has shown it to be true.

**The Significance of Phase I.**—The "Phase I" reaction may occur in all organic affections of the central nervous system.

Like lymphocytosis, it is also observed almost without exception (95 per cent., and some authors state even 100 per cent.) in syphilogenetic diseases, both syphilitic and meta-syphilitic. But, whereas lymphocytosis occurs, in addition, in persons who were once infected with syphilis, but do not suffer from organic nervous disease, a Phase I reaction occurs exclusively in patients with organic nervous disease; it is never observed in persons who have once been infected by syphilis and suffer now only from a functional neurosis (general nervousness, neurasthenia, hypochondriasis, etc.). This fact enables us to decide the diagnosis in cases which frequently occur in practice, and in which we have to face the question whether it is an early state of general paralysis in a luetic individual, neurasthenia, simple nervousness, or submaniacal phases of a circular psychosis in persons who have previously had syphilis. In all such cases the "Phase I" reaction will not be positive if it is not a case of general paralysis. On the other hand, the "Phase I" reaction is unable to assist the differential diagnosis between a non-syphilitic organic cerebral or spinal affection and a syphilitic nervous disease; for instance, it cannot help us toward a decision between multiple sclerosis and cerebrospinal syphilis.

The "Phase I" reaction in organic non-specific affections is usually slight, often very slight, in character, and sometimes is entirely absent, while in all syphilogenetic organic nervous diseases it is almost always strong, and often very strong.

**The Wassermann Reaction in Recent Cases of Syphilis without Nervous Symptoms.**—Recently M. Fränkel, as a result of studies by Fränkel, Heiden, von Zalosiesky, and von Frühwald, conducted from examinations of the spinal fluid of fresh primary and secondary syphilitics, has been able by Hauptmann's method to obtain a positive Wassermann in some cases (five to fifteen cases), when the patients manifested no symptoms of disease of the nervous system. That the Wassermann reaction may occur in the spinal fluid in recent cases of syphilis with nervous symptoms since the examinations and reports of Levaditi, Ravaut, Wechselmann, and others, is a well-established fact.

Also since the studies of Ravaut, E. Meyer, and others, it has been known that lymphocytosis in recent secondary syphilis with nervous symptoms may occur. M. Fränkel reports likewise the "Phase I" reaction as occurring in rare cases in secondary syphilis where no nervous symptoms are present. The reaction in these cases was always weakly positive. It is extremely important that such examinations should be more frequently made and that the patients with positive findings in the spinal fluid be kept under observation. Only in this way in time will we ever be able to solve the problem as to whether such patients are the ones who later on develop tabes, paresis, and cerebrospinal lues.

**The Significance of the Wassermann in the Blood.**—In relation to syphilitic organic nervous diseases we must clearly understand that it can tell us no more than that the individual has at one time been infected by syphilis, but, according to the opinion of most authors, the reaction is unable to indicate whether the individual still carries spirochætes, or whether the body somewhere still contains syphilitic products which are no longer manifested clinically. The reaction is entirely unable to tell us whether in a person with an organic nervous disease the latter is of a syphilitic nature or not. The W. R. of the blood, therefore, aids us practically only in so far as it enables us to determine the former infection in spite of a negative history, or in the absence of somatic signs. By this means the diagnosis as to a syphilitic nervous disease becomes in many cases much more probable, but this is all that the reaction can do. I may further state that the absence of the W. R. in the blood by no means excludes the possibility of a syphilitic disease. I need only point to tabes dorsalis, in which, according to statistics in all countries, the reaction is absent in 30 to 40 per cent., *i.e.*, it is present only in 60 to 70 per cent. There are also many cases of genuine syphilitic disease of the brain and spinal cord where this reaction is absent. This absence has an evident differential-diagnostic value only in regard to general paralysis. I have published my investigations in this direction in the jubilee paper to mark the sixtieth birthday of Professor Unna. Many authors have stated that this



reaction occurs almost without exception in general paralysis, certainly in more than 95 per cent. of the cases. When this reaction, therefore, is not found, we may justly doubt the correctness of the diagnosis.

**General Paralysis.**—I have further proved that if one estimates the W. R. in the blood (by a procedure introduced by Zeissler in the laboratory of Much) for higher degrees, one seldom receives any low values in paralysis. If we establish five degrees of intensity of the W. R. in the blood (the weakest being 1, the strongest 5), the degrees 5 and 4 are by far the most frequent in general paralysis, degree 3 is still fairly frequent, while degree 2 occurs rarely, and degree 1 never.

After having now briefly explained the usefulness and also the weakness of the three reactions—(a) lymphocytosis, (b) "Phase I," (c) W. R. in the blood—there remains still the discussion of the W. R. in the cerebrospinal fluid.

**The Wassermann Reaction in the Spinal Fluid.**—After the W. R. had been discovered in tabes and general paralysis in the blood, Plaut and Wassermann demonstrated it also in the cerebrospinal fluid. This had a great theoretical significance, for many authors had not yet acknowledged the etiological connection between syphilis and general paralysis, and between tabes and general paralysis. The first tests led to the opinion that the W. R. in the cerebrospinal fluid of tabetics occurs frequently, but it was soon discovered that it occurs still more frequently in general paralysis, viz., almost 100 per cent.

In 1909, at the Annual Congress of the American Medical Association in Atlantic City, I was able to state that the W. R. in the cerebrospinal fluid of tabetics is relatively rare, for it occurs perhaps only in 10 to 20 per cent. of the cases. Already, in 1908, Plant, Stertz, and myself had found that the W. R. in the cerebrospinal fluid is rare in cases of cerebrospinal syphilis. Before it was known that this reaction is infrequent in tabetics, the presence or absence of it had been used for differential diagnosis between tabes and spinal syphilis; but this is now no longer possible. These

new methods of examination still left undecided those cases in which the clinical symptoms had also failed to assist the differential diagnosis with certainty. I refer to cases of multiple sclerosis, tumor of the brain or of the spinal cord, as against cases of cerebral, spinal, or cerebrospinal syphilis. It is well known how similar these clinical pictures often are, and that the difficulty of differential diagnosis becomes even greater, if the individual in whom one suspects multiple sclerosis, or cerebral or spinal tumor, has passed through a syphilitic infection. In such cases the method of making a quantitative W. R. in the cerebrospinal fluid was of assistance. This method had first been applied by Hauptmann and Hoessli in Much's laboratory at the Eppendorf Hospital.

With this method, by the use of larger quantities of cerebrospinal fluid, it is possible to prove the W. R. in such syphilitic nervous diseases as tabes, and cerebral, spinal, or cerebrospinal syphilis, while, on the other hand, cases of multiple sclerosis, cerebral and spinal tumors (extra- and intramedullary) never show the reaction, even if one increases the quantity of cerebrospinal fluid from the original 0.2 c.c. of Wassermann to 1.0 c.c. and more. I have reported from my own practice several examples to show how I succeeded in diagnosing correctly a non-syphilitic spinal disease in a person who had been formerly infected by syphilis, and who suffered from acute spinal paraplegia. The autopsy revealed an intramedullary soft gliosarcoma of the spinal cord, as well as genuine luetic gummata of the lungs. In another case I was able to diagnose in a former luetic person a non-luetic tumor pressing on the optic nerves, and the autopsy revealed a large arteriosclerotic aneurism of the anterior communicating artery. In a third case, with a clinical history of syphilis, I could predict the syphilitic origin of a tumor with localizing symptoms in the left frontal lobe, and the autopsy revealed a tough gumma in the left frontal lobe. In a fourth case I was able to diagnose in a patient with a history of a previous specific infection that a non-specific tumor of the left anterior central convolution was the cause of the clinical picture presented, and

the operation which led to complete recovery confirmed this diagnosis.

I mention these four cases from a large number of the same category in order to show that our methods have proved useful in practice. The examination of the cerebrospinal fluid for W. R., with and without estimation of quantity, should be used especially in cases where it is important to find out whether or not the organic nervous disease is of a syphilitic nature.

**The Value of the Four Reactions in Differential Diagnosis.—**

The results of the four reactions are of especial value in differentiating organic disease of the nervous system as a consequence of alcoholism, particularly where syphilis is found in the anamnesis. It is well known how much pseudotabes alcoholica and pseudoparesis alcoholica can resemble the syphilogenetic tabes and paresis. In the alcoholic peripheral neuritis and myelitis funicularis, as well as the alcoholic paresis, lymphocytosis, Phase I, and the Wassermann reaction in the spinal fluid are absent, while in those cases where the patient had a previous syphilitic infection the W. R. in the blood may be positive.

I deem it practical to sum up, in conclusion, the use of the "four reactions," in tabulated form, as follows:

*1. Examination of the Blood. Wassermann Reaction.*

(a) Positive: It is characteristic of syphilis; there are few, if any, exceptions. The reaction is positive; also in some cases of recent scarlatina, malaria, leprosy, framboesia, etc.

Positive W. R. of the blood means no more than that the person has once been in contact with syphilis (hereditary or acquired), or that somewhere in the body a specific lesion still exists, but it does not mean necessarily that the disease in question must be luetic.

(b) Negative: It can be used in differential diagnosis with great probability against the existence of general paralysis, for the blood of paralytics reacts, with rare exceptions, positive.

*2. Examination of the Cerebrospinal Fluid.*

(a) Normal fluid: Pressure in vertical tube 90 to 130

mm. water; Phase I reaction negative; 5 to 6 cells per c.mm. at the most (Fuchs-Rosenthal); W. R. negative after the original method (0.2 c.c. of fluid), as well as after using larger quantities (0.3 c.c. to 1.0 c.c. of the fluid).

(b) Pathological fluid:

(1) Increased pressure of escaping fluid (above 150 mm. water).

(2) Phase I reaction positive.

(3) Lymphocytosis.

These three symptoms (either combined or singly) indicate that there exists an organic disease of the central nervous system (specific or non-specific). If Phase I and lymphocytosis are positive, these two reactions indicate the probability of syphilis.

(4) The W. R. of the cerebrospinal fluid decides whether the disease of the central nervous system is of a luetic nature. If it is already positive by the original method (0.2 c.c. of fluid) there is great probability that the case in question is one of general paralysis or taboparalysis; less frequently, of tabes and of cerebrospinal syphilis. In the large majority of cases of general paralysis the W. R. is usually positive on using only 0.2 c.c. of fluid, but in some few cases, and in most cases of cerebrospinal syphilis and of tabes, the W. R. is positive only on using larger quantities of cerebrospinal fluid (0.3, 0.4 up to 1.0 c.c.).

**Typical Findings.**—1. *General Paralysis or Taboparalysis.* (1) W. R. in the blood positive (almost 100 per cent.).

Pressure of cerebrospinal fluid often increased. (2) Phase I—reaction positive (in about 95 to 100 per cent.), usually strongly positive. (3) Lymphocytosis (in about 95 per cent.), usually marked. (4) W. R. in the cerebrospinal fluid.

(a) Positive in about 90 per cent. after the original method (0.2 c.c. of fluid).

(b) In 100 per cent. by using larger quantities.

2. *Tabes* (without combination with paralysis).

(1) W. R. in blood-serum positive in about 70 per cent.

Pressure of cerebrospinal fluid often increased.



(2) Phase I—reaction positive in about 95 per cent., usually strong.

(3) Lymphocytosis in about 90 to 95 per cent., usually strong.

(4) W. R. in the cerebrospinal fluid.

(a) After original method (0.2 c.c.) positive in about 20 per cent.

(b) With larger quantities positive in almost 100 per cent.

### 3. *Cerebrospinal Lues.*

(1) W. R. in blood-serum positive in about 70 to 80 per cent. Pressure of cerebrospinal fluid frequently increased.

(2) Phase I reaction, only in exceptional cases, negative, otherwise positive, generally not as strong as in paresis and tabes.

(3) Lymphocytosis, like Phase I, almost always positive, but not so marked as in paresis and tabes.

(4) W. R. in the cerebrospinal fluid.

(a) With original method (0.2 c.c.) positive in about 20 per cent.

(b) With larger quantities of fluid almost always positive (of special value for the differential diagnosis as against multiple sclerosis).

**The Importance of the Four Reactions in Determining the Recovery of the Patient.**—The testing of the four reactions is also exceedingly important in those cases where the question is to be determined as to whether complete recovery has occurred. Only where all four reactions are negative are we justified in speaking of an objective cure. The old saying of Fournier, "Syphilis does not die, it only sleeps," may be applied with correctness to the majority of cases of cerebrospinal syphilis and almost all cases of tabes and paresis. Where, however, the four reactions are all negative one may conclude that the syphilis of the patient has really ceased to exist. I have observed a large number of such cases. The persistence of one or more of the four reactions demands a continuation of the treatment in cerebrospinal lues. In tabes and paresis the persistence of the

three reactions in the spinal fluid is no indication for the continuance of the treatment, for in these two diseases the three reactions, except in rare cases, are uninfluenced by any therapy that we are at present familiar with.

**The Significance of Hæmolysin.**—Recently investigations have been instituted by Von Weil and Kafka concerning the hæmolysin present in the spinal fluid. Hauptmann, in my department at Eppendorf, and Eichelberg, in Cramer's clinic at Göttingen, are at present making control examinations. Whether this reaction as a matter of fact occurs only in paresis, as Von Weil and Kafka assert, control examinations must determine. These two observers themselves admit that it does not occur in all cases of paresis.

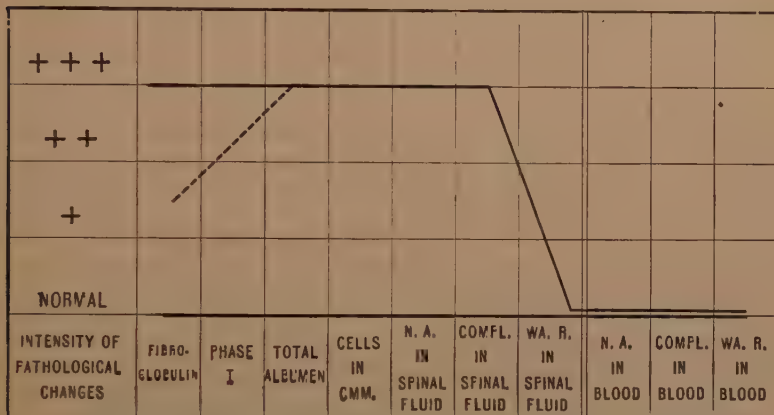
Quite recently V. Kafka has broadened the field of the reactions. He examines for the presence of fibrinoglobulin in the spinal fluid, of amboceptor in the blood and fluid, as well as complement in both blood and spinal fluid. By the utilization of all these different reactions (the old Phase I, pleocytosis, and Wassermann reaction in blood and spinal fluid, are, of course, included), Kafka, when he presents them graphically in the form of curves, obtains pictures which are presumed to be somewhat characteristic for the various types of syphilitic nervous disease.

To obtain these reactions Kafka proceeds as follows:

In the fibrinogen, one adds in the proportion of 28 per cent., a saturated solution of ammonium sulphate to the spinal fluid; for example, 1.44 spinal fluid, 0.56 ammonium sulphate solution, shakes well and reads the reaction as negative or positive after it has stood several minutes. The Phase I is made, if possible, for the total globulin determination according to the method of Nissl or Zalozieski. The cells are counted in the Fuchs-Rosenthal counting chamber. The normal amboceptor and complement is then determined. One adds to 0.1 of inactive or active serum  $\frac{1}{2}$  c.c. of a 5 per cent. solution of sheep's blood-corpuscles and to the tubes with inactive serum 0.05 complement and then normal salt solution up to one c.c. If the normal amboceptor is absent in the blood then to demonstrate complement one must em-

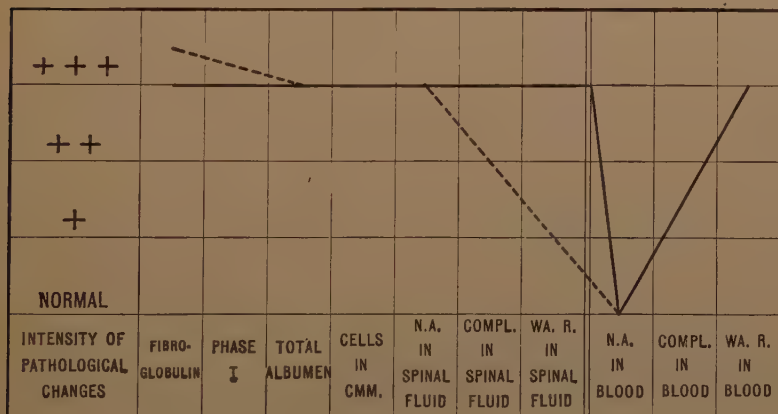
ploy immune amboceptor. The hæmolysin reaction in the spinal fluid requires at least 5 c.c. of fluid.

These pathological changes in the spinal fluid are represented roughly by elevations above the abscissa axis. Nor-



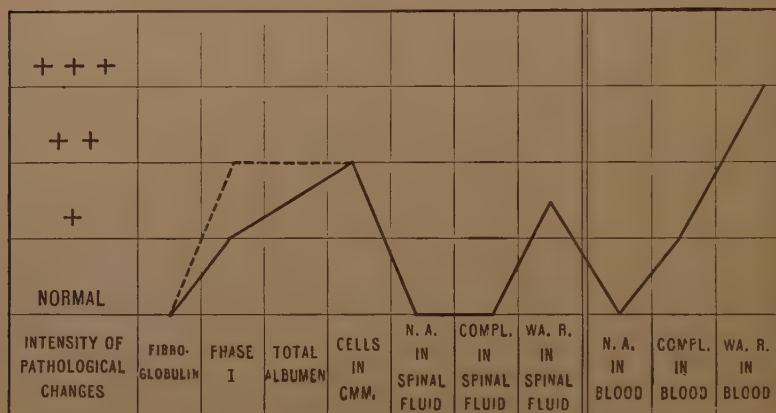
mal amboceptor is represented by (N.A.), complement by (Compl.), etc.

In the acute non-specific meningitis, Curve II, in the first

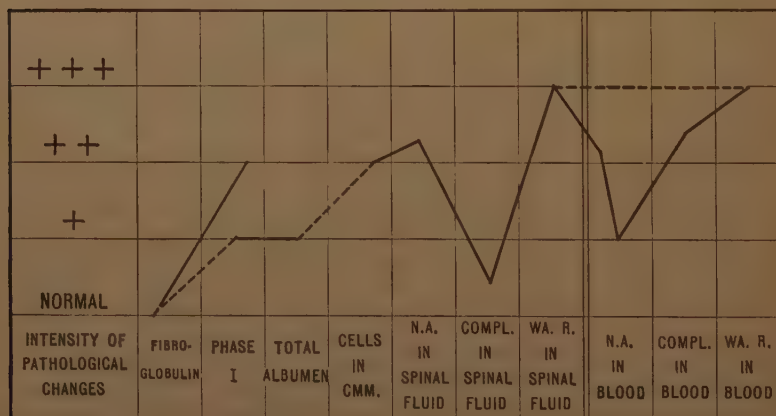


part runs along the abscissa + + +, posteriorly along the normal abscissa. Here, naturally, the morphological examination must determine the kind of meningitis. A number of authorities have reported cases in which in non-

specific meningitis and a positive W.R. in the blood, also a positive W.R. was found in the spinal fluid. The fibrin-globulin reaction may often, even in tubercular meningitis, be less intense than indicated by the curve.



Curve III: The acute early specific meningitis forms in general as is indicated in Curve III. The complement quantity in the blood is often diminished here; less often there is



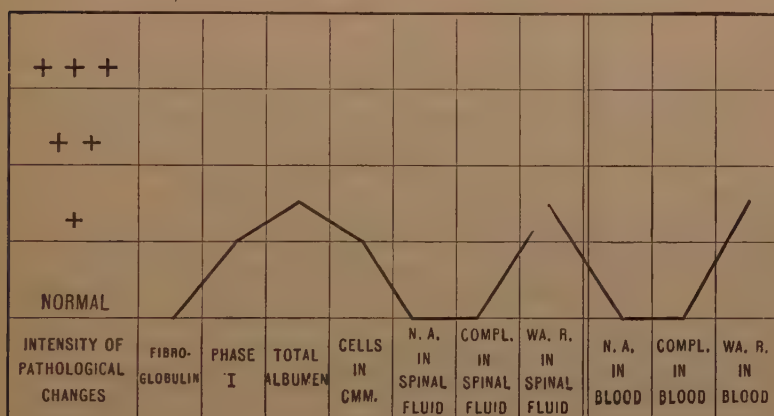
a decrease of the hæmolytic properties of the blood, especially in fatal acute specific meningitis after salvarsan the rapid and marked coagulation is striking. According to Plaut, Rehm and Schottmüller, even in cases of severe



meningo-myelitis with marked increase of globulin and cells, the W.R. in the spinal fluid, with 0.2, may be negative.

Curve IV: The curve of paresis shows a negative fibrin-globulin reaction; one often finds in the blood an absence of the hæmolytic complement, less often a diminution of the hæmolytic normal amboceptor. Sometimes both are not demonstrable. It may be mentioned also that even with a diminished Phase I and lessened albumen content normal amboceptor may occur in the spinal fluid.

Curve V: The curve of the non-acute tertiary brain lues,



the gummatous endarteritic and chronic meningeal forms of the tertiary stage, resembles to some extent the curve in paresis. However, normal amboceptor and complement probably never occur in the spinal fluid, although Phase I and the total albumen content may be stronger than indicated here. The diminished W.R. in the spinal fluid has a differential diagnostic value. The complement content in the blood in rare cases is diminished. Old cases, especially endarteritic lues, show much diminished and often entirely negative reactions.

Curve VI: The curve of tabes resembles somewhat in type the one of lues cerebri. It is, however, in its reactions usually lower and very often the W.R. in the blood is absent.

Kafka says, when we represent schematically the results



non-specific disease of the central nervous system with a specific one, whether stated in the history or not. Owing to the stated sources of error, of which there still exist many, it follows that even if one uses all four reactions, one has still to observe the greatest critical caution in diagnosis. If the observer does not wish to run the risk of grave diagnostic errors, he has still to apply a careful and detailed clinical examination in each individual case, working hand in hand with the more modern methods. Some skeptics and critics have already sarcastically remarked that the pivot of medical examination lies, nowadays, in the laboratory, but this is by no means correct. It is noteworthy that Hoche, the psychiatrist in Freiburg, who formerly was exceedingly skeptical, has recently in a monograph concerning paresis recognized the diagnostic value of the four reactions after he himself had put them to practical test. On the other hand, we may say, after some years of careful and conscientious testing of these modern methods of examination, that by their complete mastery and their logical and critical application, we have obtained an excellent aid towards the diagnosis of the affections of the central nervous system, especially of the syphilitic ones.

## XVIII

### PROPHYLAXIS

IN the discussion of the treatment of syphilis naturally the prophylaxis comes first. Prophylaxis, of course, consists in the avoidance of specific infections. When Gowers in impressive words lays on the heart of his hearers the importance of an unbroken chastity, so it is to be hoped that such advice might be given oftener in our universities to the embryo physicians. I am convinced that many of our medical men do not properly appreciate their responsibility when, for any reason whatever, they advise sexual intercourse for their unmarried patients. Nevertheless, we must all acknowledge that sexual abstinence for the great majority of young men will probably remain an unattained ideal. The society for fighting the spread of venereal diseases, which was founded several years ago in Berlin and at whose head were such men as Neisser, Lesser and others, sought to exert a beneficial influence along educational lines through the distribution of suitable literature and public addresses. A similar plan has been followed in the schools where the pupils during their last years have been instructed on this subject. Of the school instruction I do not approve. A conscientious father is the proper one to assume this task, or possibly the family physician. At any rate, in my opinion, the sexual theme is scarcely a fitting subject to discuss before a forum of youths who are barely in their teens. One can say at least to the growing youth that sexual intercourse is not absolutely essential for his physical welfare, that wet dreams furnish the natural relief for his sexual demands. The Catholic clergy demonstrate the harmlessness of sexual abstinence.

With reference to the extragenital infection there is no prophylaxis, because in the great majority of the cases the infection takes place when it is the least suspected.

**Physical and Psychic Trauma, Alcoholism.**—It belongs to the realm of prophylaxis also that syphilitics who are



inclined to nervous affections, either on account of family tendency or through their individuality, should avoid on the physical side spinal and head injuries, and on the psychic, mental strain and strong emotion. These recommendations, however, have only academic worth. It is of much more practical value to advise one's patients to be extremely moderate in the use of alcohol and tobacco. There is no doubt that, next to syphilis, alcohol is the most injurious nerve poison.

#### **Intelligent Treatment of the Primary and Secondary Lesions.**

—Can intelligent and energetic treatment of the primary and secondary lesions banish the spectre of nervous syphilis? This question already has been thoroughly discussed in the consideration of the prognosis of brain lues. The answer of such observers as Möller, Goldflam, Hoppe, Savard, Julliard, Schultze, Schmaus, and many others, is that one, at any rate for many cases, must reply to the above question in the negative. I have heard this negation in many conversations with exceedingly well-informed physicians, and I must confess that mine must be enrolled with the rest. It may be said that in this regard the syphilologist overestimates the importance of specific treatment. It is true for both brain and spinal cord what Fournier first stated in respect to the brain: that there are cases of brain syphilis in which the tendency of the toxin from the very beginning seems directed towards the central nervous system, and in a malignant manner, since antispecific treatment as a prophylactic fails in stopping the advance of the affection. In spite of this fact, however, in every case it is advisable, as early as possible, to institute a thorough and energetic treatment in primary and secondary syphilis in the hope of warding off future nervous complications.

It is worthy of recommendation, if it could be carried out in general practice, to advise following the custom of the St. George General Hospital in Hamburg. This hospital gave to every syphilitic patient at the time of their discharge the following printed instructions:

You are affected with a venereal disease (syphilis). You must take care that you do not transmit your disease to others, which may be done

by sexual intercourse, kissing, by sleeping in the same bed and using the same dishes and drinking out of the same cups with others.

Your disease cannot be cured in a single course of treatment. You will in all probability again notice symptoms of your affection, as ulcerated patches or pains in the mouth or in the neck, or on the private parts, or in the form of an eruption on the body. As soon as you observe any of these symptoms you must immediately place yourself under medical care. Beware of quacks, cures by nature's methods, and all such silliness. For the proper treatment of your disease a thorough knowledge of all methods of therapy is essential and such knowledge is only possessed by a regularly licensed physician. Also when no symptoms of your disease are manifest, you should put yourself under medical care once every four months in order to take a course of treatment. This course of treatment does not necessarily require your going to a hospital or the giving up of your regular work. When you have taken regular courses of treatment over a period of three years, you may in all probability expect to be spared the later and severe symptoms of your disease, such as bone decay, nerve and spinal-cord affections, premature apoplexy, etc.

Only after four or five years has elapsed since your infection, and then after securing the approval of your physician, should you think of getting married. If you do not heed this injunction, you will be liable to transmit your disease to your wife and children.

By suitable and long-continued treatment you can expect to obtain a complete cure.

**Treatment with Mercury and Iodid.**—In lues of the brain and spinal cord the treatment should begin as soon as the diagnosis is made. The warning of Althaus against the administration of iodid in the very beginning of brain syphilis does not seem justified.

**Inunctions, Injections, Sack-therapy and Internal Medication.**—When it is possible to carry out, insist upon treatment by mercurial inunctions, because it is the most thorough and quickest in effect. Neumann, of Vienna, after an unusually large experience, has also come to this conclusion. As a supplementary treatment when the symptoms do not disappear quickly enough or remain unchanged in the first three to six weeks, every four or five days an injection into the nates may be made of salicylate of mercury in a 10 per cent. solution, of which the following is the formula:

Hydrarg. salicyl. ....	1.0
Paraffin liquid .....	10.0

Sig.—To be well shaken before using.

**Lewin's Sublimite Injection.**—This injection is convenient in those cases where, for some reason, such as lack of

time, concealment, skin disease before the beginning of the inunctions or as a consequence of them, so that the rubbings cannot be administered and the physician considers necessary a more frequent dose of mercury than can be given of either the mercury salicylate, oleum cinereum, or calomel.

Formula: *Lewin's sublimate injection.*

Hydrarg. bichlor. corros.....	0.3
Sodium chloride .....	3.0
Aqua destillata .....	30.0
Sig.—1 c.cm. injected equally in two different places in each buttock, once or twice daily.	

Welander has recommended the mercurial sack-therapy. In this method of mercurial administration the patient wears a flannel cloth smeared with mercury or a flannel sack filled with it around his body. Welander states that this form of mercurial treatment works quickly and effectually. The apron or sack should be worn without interruption for from four to six weeks and acts upon the organism by slow evaporation. This method has been endorsed by such men as Schuster, Neumann, and A. Neisser. It is an agreeable way of giving mercury, but not so certain as the inunction and injection methods. The injections of calomel and oleum cinereum bring with them the danger of abscess formation. Notwithstanding this, Harthing and Dreyfus have recently strongly recommended calomel injections.

The following is the formula for a calomel injection:

Calomel	
Sodium chloride aa .....	5.0
Aqua destillata .....	50.00
Mucilage of tragacanth .....	2.5

For an oleum cinereum injection:

Hydrarg.	
Lanolin aa .....	3.0
Olive oil .....	4.0

The dose of both of these formulæ is 1 c.cm. injected once every fourth, fifth or sixth day. Five or six injections are equal to a course of from 24 to 30 inunctions.

Recently Zierler in Neisser's clinic has recommended quite highly injections of gray oil. He uses a mixture which consists of 40 per cent. mercury, 13.5 lanolin and 46.5 per cent. paraffin, and which remains liquid at 15 degrees Celsius; that is, does not need to be warmed but only to be shaken before using. This solution causes the least pain. The dose is 0.28 cm. Zierler regards this mixture when properly prepared as absolutely free from danger and ascribes to it the best results in secondary and tertiary lues.

Neisser recommends the gluteal region as the best place for injections. It is important to remember when administering mercury by injection that iodid should never be given at the same time, otherwise the formation of gluteal gummata may occur.

In France and England mercury is administered more in the form of pills and powders than in Germany. Since the results obtained cannot be doubted, when one is unable to give inunctions or injections the mercury may be administered in this way. If diarrhœa appears as a consequence of the pill or powder medication then sufficient opium may be added to relieve it.

*Ricord's pills, hydrargyri, iodidum flavum.*

Lectucarni gallici āā .....	3.0
Ext. opii aquæ .....	1.0
Ext. conii maculati .....	6.0
in pill No. 60	

Sig.—Take one pill 15 minutes after the evening meal.  
Later, one pill morning and evening.

The following is the formula for hydrargyri tannicum:

Hydrarg. oxydulat. tann. ....	5.0–10.0
Bol. alb. {	q. sat. ad pill No. 100
Glycerin }	

Sig.—Take two pills daily, morning and evening.

Recently syphilologists have used a preparation called Enesol. It is dispensed in ampules, each 2 c.cm. or ampule containing .06 gramme Enesol. It is given either in twenty injections in succession or in ten injections with a pause. This preparation sometimes causes colitis.



Do not be timid in your doses, but begin at once with 4 Gm. unguentum ciner. as an inunction and gradually increase up to 5 and 6 Gm. My former chief, Dr. Engel Reimers, who has had an unusually large experience, came to the conclusion that nothing more was to be accomplished by rubbing in a larger quantity than 6.0 Gm. unguentum ciner. at one time. If one is justified in giving such enormous doses as Krauss has done,  $11\frac{1}{3}$  grammes sublimate intramuscularly daily for ten days in succession, I doubt very much.

**Mercurial Neuritis.**—The occurrence of a mercurial poly neuritis has been often doubted. The observations of Ketly, Forestier, Leyden, Spillman, and Etienne, according to my opinion, leave no foundation for doubt. We can state at the present time that the occurrence of a mercurial polyneuritis must be admitted. However, such cases are exceedingly rare, and in my experience of nineteen years in hospital and private practice I have never seen a case originating from mercury administered as a therapeutic agent. Erb's experience has been the same.

**Treatment by Inunctions.**—Whether a bath should be given daily or only at the end of the inunction cycle depends upon the case. The effect of the mercury remaining on the body several days at a time is more intense and permanent. Recently Hoesslin has reported very good results in brain syphilis with the inunction treatment and daily baths. He considers the rule to bathe only after a cycle is ended not well grounded. After the termination of a cycle, whether it is of four, five, or six days' duration, to allow two days of intermission (the first of which should be used for cleansing purposes with soap and lukewarm water) is to be strongly recommended.

In regard to the number of inunctions, my custom in all cases, even though the symptoms have disappeared, is to administer about thirty.

In every case of lues of the nervous system iodid should also be given, for it is regarded, and correctly, as a specific in the tertiary syphilitic manifestations and the specific pathological processes which form the foundation of ner-

vous syphilis are at the present time, in general, enrolled in this category. The period of time between the invasion of lues in the body and the appearance of inflammatory and gummatous products according to this classification is not material.

It is best to begin with small doses,  $1\frac{1}{2}$  grammes *pro die*. If the iodid is tolerated well, then increase rapidly to larger doses. One may give without harm for two or three months at a time from 4 to 6 grammes of iodid daily. In many cases sodium iodid is tolerated better than potassium or strontium, and rubidium iodid better than the sodium. A combination of different iodid salts has been much recommended, as of the potassium, sodium, and ammonium. The iodid is often better borne if one adds to one teaspoonful of the customary dose of iodid two or three drops of Fowler's solution. It is not advisable to stop the iodid at the first appearance of intoxication symptoms, since very often after a short time the patient becomes accustomed to the drug and these pass away.

Among the newer preparations of iodine iodipin is to be recommended. Iodipin comes in 10 or 25 per cent. solutions of iodine in oil of sesame. It may be injected into the gluteal region in doses of from 10 to 20 c.cm. daily for a period of 10 days, then an interval and a repetition of the injections. Internally iodipin may be given in the 10 per cent. solution in teaspoonful doses three times a day. Another preparation of iodine that is comparatively free from bad effects is sajodin. It contains 60 per cent. of iodine. The dose is from 1 to 3 grammes *pro die*, which may be increased even to 6 grammes. A large number of other iodine preparations have recently made their appearance, the most of which are unimportant.

**Indications for Mercury and Iodid.**—Both of these therapeutic agents, mercury and iodine, are able to influence syphilitic tissue. In general the impression prevails at the present time that mercury has the most effect on a true inflammation, while iodine acts more efficiently on gummatous formations.

In a study of the subject by Stern made from Jadas-

sohn's clinic, and also from a review of the literature, it appears that there are still widely different opinions as to the relative value of both these agents in the different periods and various lesions of syphilis.

The following views were found to have been expressed in the literature on this subject:

1. Mercury and iodine are effective in all the diseased processes of syphilis, but the mercury is the more efficient in the early stages and the iodine acts more energetically in the later stages.

2. Mercury acts only or only essentially upon the early processes, while iodine acts only or only essentially upon the late processes. At the same time, however, it was quite generally admitted that iodine possesses an influence upon certain symptoms occurring in the early period, such as occipital headache.

3. Mercury acts on all the stages of syphilis, while iodine chiefly affects the tertiary stage.

The majority of the modern authorities take the view that mercury is the most effectual early in the course of the disease and iodine in the later manifestations. In practice, however, a combination of the two specifics is usually administered at the same time, since the differential diagnosis between early and late syphilis on the skin, mucous membrane and internal organs is often exceedingly difficult.

Stern, from his experience in Jadassohn's clinic, came to the conclusion that a syphilis which had been treated in the earlier stages with mercury, in the later stages responded promptly to iodine.

Oppenheim gives the preference to mercury in syphilis of the nervous system.

**Action of Mercury in Non-specific Affections.**—It may be said that iodine sometimes, although rarely, acts upon other growths, and especially gliomata, and Gowers states that he saw an optic neuritis, for the assumption of whose specific nature there was no other basis than that it disappeared under the administration of iodine.

There are also cases which present the clinical picture of a cerebral tumor with choked disc and hemiplegia, which

are not specific in character but which disappear under inunctions of mercury with and without the combination of iodine. Such cases in adults I have classified under the name of pseudotumor cerebri. In eight such cases in my own experience a partial recovery occurred. Further communications in the literature on this subject have been made by Henneberg, Berlin; Saenger, Hamburg; Hoppe, Cincinnati; Finkelburg, Bonn, and others. The occasional influence of iodine on non-specific tumors has been acknowledged by Oppenheim and Bruns in their work on tumors.

**Duration of Specific Treatment Where the Symptoms Continue Refractory.**—Concerning the question as to how long mercury and iodine should be administered where no improvement in the symptoms occur opinions differ greatly. There are no doubt numerous cases reported in the literature in which the antispecific therapy has been continued for years and only after years have the symptoms disappeared. Such cases cause the critical observer to wonder whether a spontaneous recovery has not taken place during the treatment rather than on account of it.

In general one can state that in true cases of syphilis of the nervous system one should expect an improvement in the symptoms at the end of the second week, or at any rate at the end of the third week.

Gowers has expressed the opinion that what has not disappeared after from six to ten weeks of mercury and iodine administration will resist further antispecific therapy; also that the persistence of the symptoms must not be an indication for the continuation of the antispecific treatment. In my own practice, when after the antispecific therapy has been given for a period of six weeks and no improvement has occurred, I have usually discontinued it. Occasionally, however, success may result in rare cases from a further continuation of the treatment.

When the general health of the patient suffers as a result of the treatment it is, of course, best to stop it for a while and permit the patient to regain his strength and then begin it over again. As a rule several courses of treatment should be given every year for two or three years. Gowers ad-



vises for a period of eight years after the infection and five years after the last appearance of florid symptoms to give iodine for several weeks, twice yearly. Endeavor always to keep your patient under observation, because the tendency of syphilis of the nervous system to relapse is great and it lies in the nature of the affection to reappear in a different form and in another location.

**Chronic Intermittent Treatment.**—In Germany, A. Neisser, and in France, Fournier, have advocated the chronic intermittent treatment of syphilis. Fournier sees in this method the only means of limiting the development of paresis. It is scarcely necessary to state that many experienced neurologists think otherwise. However, when such men as Fournier and Neisser and such experienced neurologists as Gowers advocate this form of treatment, one feels an obligation, even against his own experience and judgment, to follow their instructions. Fournier's advice is in the beginning of syphilis to institute energetic mercurial treatment and continue it with intermissions for a period of two years, then for a period of two years cease all antisyphilitic therapy. In the fifth year after the infection to give again another year of mercurial treatment, which should in the seventh or eighth year after the infection again be repeated.

Objection has been made to this form of treatment because of the danger through its long continuance to the development of a toleration on the part of the specific organism to the medication.

Another danger of too-long-continued mercurial and iodine medication lies in the fact that the tendency of the individual to degenerative affections of the nervous system may increase because of a general constitutional weakening of the system, since mercury and iodine are not to be regarded as indifferent drugs to the organism. This danger is in reality not a very great one.

A special study of the advantages and disadvantages of the chronic intermittent method of treatment has been made by Perl. He comes to the conclusion that the objections to the method are not well founded and also that the chief cause of the appearance of tertiary symptoms is due to

insufficient treatment during the primary and secondary stages. It should be mentioned, however, that Perl's material was entirely of a tertiary nature and that his experience does not include metasyphilitic affections.

**Antimercurialism.**—At the present time the bitter fight which was made against the use of mercury in syphilitic affections by such men as Hermann and Lorinser has been almost forgotten. The chief arguments of the antimercurialists were found in the miners who worked in the quicksilver mines and developed similar lesions in the bones to those occurring in syphilis, and also not infrequently in cases of tertiary and secondary lues the symptoms disappeared only after a complete cessation of the mercurial treatment. The classical studies of Virchow and later Kussmaul have effectually contradicted these contentions, and they are only interesting now historically.

**Refractory Behavior of Genuine Specific Processes to Mercury and Iodine.**—One's faith in the therapeutic value of mercury and iodine should not be shaken, because occasionally a true specific lesion is encountered which does not yield to either one of these agents. I have had several such experiences in which specific gummatous processes, after long and energetic treatment with mercury and iodine, remained uninfluenced. One of these lesions was located in the optic chiasm, one in the cortex of the frontal brain, and two were found (postmortem) on the spinal-cord membranes.

It not infrequently happens during antispecific treatment that new and severe nervous symptoms appear. Such observations are so numerous in the literature that only a few can be referred to. Goldflam saw during the course of an energetic antispecific treatment the development of a syphilitic myelitis, and Gowers reports a case in which a specific meningitis with gumma in the brain and spinal cord appeared during antispecific therapy.

**Optic Atrophy a Contra-indication.**—Many authorities consider an optic atrophy as a contra-indication against the use of mercury and iodine, because there are numerous cases reported in which the atrophy progressed faster under mercurial medication. One should remember, however,

that an optic atrophy may be caused by a primary degeneration of the optic fibres, as well as by an interstitial or gummatous optic neuritis, and that in the latter instance energetic antispecific therapy is especially indicated.

Since one is not always able, either by the ophthalmoscopic picture or the field of vision, to determine the origin of the atrophic process, one is often in doubt as to the proper course to pursue.

In such cases my plan has been, after the completion of each cycle of inunctions (four, five or six inunctions), to take the field of vision and also make an ophthalmoscopic examination. If this examination shows that either the ophthalmoscopic finding or the power of vision is worse, I discontinue the treatment.

**Atoxyl.**—Much has been written during the last few years concerning the use of atoxyl in the treatment of lues. The experiences of Bornemann, Krudener, Lesser, Graaf, Robert Koch, Fehr, and Nonne show that with large doses and also small ones an optic blindness may appear, which frequently develops without premonitory symptoms rather suddenly, and for this reason it makes this agent dangerous. One sad experience of my own has caused me to lose my courage with regard to its administration.

Since the era of salvarsan this remedy has only an historical interest.

**Bath Resorts.**—In cases where one wishes to stimulate the eliminative processes and to increase the capacity of the patient for mercurial treatment the famous sulphur baths of Aachen, Tölz, and Nenndorf may be recommended. Also the thermal baths of Nauheim, Oeynhausen, Wildbad-Schwarzwald and Wildbad-Gastein, Baden-Baden, the baths of Leuk in Switzerland and at Wiesbaden, as well as the different salt-baths, have justly a good reputation for this purpose.

**Zittman Cure.**—The Zittman cure has been in times past often recommended in cases where the symptoms continued refractory to mercury and iodine, or where these agents were badly tolerated. In tertiary symptoms of the mucous membrane, skin, and bones this method is still made use of

at the present time, but in specific disease of the nervous system its use is not advisable because chiefly of its tendency to weaken the constitution.

**Tonic Measures.**—It is very important in the treatment of syphilis of the nervous system that the general nutrition and strength of the body should be looked after by well-directed tonic measures. The neglect of this cardinal rule alone may cause failure with the mercurial treatment. The entire hygiene of the organism must be drawn upon. The utilization of hydrotherapy, a strengthening and non-irritating diet, abstinence from or moderation in the use of alcohol and tobacco, and the avoidance as far as possible of too great mental activity, are to be strongly advised. Do not forget to treat the sick individual as well as the sick body. Mental depression often accompanies a specific infection and one should always endeavor as far as possible to combat this in every way.

**Psychic Treatment.**—In the hypochondriacal states which are often encountered in luetics it requires all the skill of the physician to successfully combat them. The patients become syphilophobiacs and imagine themselves to be tabetic or paretic. They are generally stubborn cases. If one does not treat them specifically then they complain that specific treatment, and that alone, is necessary for their recovery; if one treats them specifically, they also complain that they are still syphilitic and that their condition is incurable. In such cases it is the physician and not the medication who must cure his patient, *medicamente, non-medica-mentis*. Not infrequently one observes that these tabes-paresis hypochondriacs are finally correct in their forebodings and later develop cerebral and spinal disease. The cases in which an actual paresis appears after years of hypochondriacal fears have been observed by all experienced practitioners.

**Therapeutic Indications for Individual Forms of Nervous Lues.**—The treatment of arteritic apoplectiform attacks should in the beginning be the same as in the non-specific apoplexies, thromboses, and emboli. The patient should



have absolute mental and physical rest, cold to the head, and a non-stimulating diet. Only when the apoplectiform symptoms have passed over should the antispecific treatment be instituted. The specific treatment should first be directed towards endeavoring to bring about a healing of the arteritic process and then later towards preventing an extension of the disease to other vessels and thus the occurrence of further apoplectic attacks.

Cases of relapses after energetic and long-continued treatment teach us unfortunately that this is not always possible.

In the treatment of specific disease of the peripheral nerves after the termination of the antispecific therapy, massage and electricity will be found beneficial.

In the permanent consequences of brain and spinal-cord necrosis one may utilize all the therapeutic aids which are administered in non-specific hemiplegias and paraplegias, such as hydrotherapy, massage, and electro- and mechanotherapy.

Sensory and motor symptoms of irritation often require sedative and narcotic treatment. These conditions must be dealt with symptomatically.

Particular stress should be laid on the care of the bladder function and the avoidance of decubitus. The bladder paresis often leads to cystitis, this extending upwards to pyelitis and pyelonephritis, and thus causes the death of the patient with symptoms of uræmia or sepsis. On the other hand, decubitus, through the weakening of the patient or because it brings about a general sepsis, produces of itself the fatal termination in patients where the spinal process has been healed. I know of many cases, both in private practice and in the hospital, where, by carefully directed attention to the bladder function and prophylaxis against decubitus, the general health of the patients was maintained in fairly good condition for many years. One should endeavor to prevent the first beginning of a decubitus, and a commencing cystitis may be greatly benefited by washing out the bladder if this procedure is carried out

under the strictest aseptic precautions. Practical experience has taught me that failure in this last injunction occurs more often than one would imagine.

**Surgical Treatment.**—In recent years the surgical treatment of brain syphilis has frequently been under consideration. It has been previously stated that brain lues may appear, presenting the symptoms of a brain-tumor, and usually when this occurs the symptoms are those of cortical tumors. There are symptoms of sensory and motor irritation which may be accompanied with paralysis, choked discs, and occasionally other evidence of pressure. Naturally when the supposed tumor has been diagnosed as specific in nature antispecific therapy will be instituted, but numerous experiences have taught us that not infrequently specific tumors are refractory to treatment; they do not yield to it. Bergmann, in the first edition of his book on brain surgery, advises against operation in syphilitic tumors, but Horsley and Gowers, upon the basis of pathological studies which proved gummata to be incurable by means of mercury and iodine, recommended surgical removal for specific tumors which can be reached, as the only rational therapy.

In 1910, Horsley, at the meeting of the German Neurological Congress held in Berlin, advocated trepanning in all cases where gummatous disease of the brain could be definitely determined and then local treatment in the form of irrigation with a 1 to 1000 corrosive sublimate solution. In the discussion which followed strong antagonism was plainly manifested towards so radical a method of treatment.

Oppenheim states in his monograph on brain-tumors that Macewen, Horsley, Harrison, Lampiosi, Parker, Rannie, and Sands have removed successfully tumors of syphilitic origin. He further states that Macewen and Bramwell advise that the indurations which are often left after the termination of a specific cortical affection should be removed if they cause a chronic epilepsy and other severe brain symptoms.

Oppenheim, in 1897, stated that there are a number of conditions in brain syphilis in which a surgical procedure

may be indicated. Bruns says in his book on tumors of the nervous system that when a specific affection assumes the form of a brain-tumor antispecific therapy should at first be administered. If the antispecific treatment does not bring about improvement inside of six weeks, then there is time to proceed with the operation.

In 1898 Schlesinger and Friedländer, after a thorough study of this question, came to the following conclusions:

Indications for surgical interference in known or supposed brain syphilis:

1. Stationary tumor after antispecific treatment, which is easily accessible and of supposedly small circumference.

2. Progression of the symptoms in spite of treatment, if an *indicatio vitalis* exists.

3. In spite of antispecific treatment, Jacksonian epilepsy, although the earlier symptoms of tumor have disappeared.

In a case reported by Fischer a gumma of the dura developed over the right parietal lobe broke down and produced necrosis in the parietal bone. This abscess caused a cortical epilepsy with left hemiplegia and unconsciousness. Surgical treatment of the abscess followed by the administration of iodine resulted in a complete healing of the local process and a disappearance of the brain symptoms. The specific nature of the tumor was confirmed by the appearance of fresh gummata over both tibia.

The following case is very instructive in this connection:

A man, forty years old, was received into the hospital with the diagnosis of idiopathic epilepsy. The history showed that he had suffered with epileptic attacks for six months, which occurred two or three times a week, and bore the character of severe idiopathic epileptic attacks. He denied syphilitic infection. Still, a number of consecutive abortions of his wife made his history suspicious. He also stated that during the past few months he had taken a course of inunctions. The last four weeks he had complained of severe headaches and was apathetic. On the day before his admission to the hospital he had a number of severe epileptic attacks. The objective examination was

not entirely satisfactory because of the dazed condition of the patient from the attacks of the day before. It was established, however, that there were no paralyses of the cranial nerves or of the extremities, and that the cranium was sensitive to percussion, especially over the left parietal bone. Antispecific treatment was begun, but the same night he was seized again with a succession of the same epileptic attacks, from which he died.

The autopsy revealed a hard caseous circumscribed tumor the size of a walnut, situated between the dura and the cortex over the region of the left paracentral lobule. The dura was thickened and fibrous in all directions extending out from the tumor, and the cortex just beneath the tumor was infiltrated with a caseous substance. Careful examination of all the organs and tissues at the autopsy revealed no other signs of either syphilis or tuberculosis. The microscopical examination of the tumor, as well as of the infiltrated cortex, presented a typical picture of a syphilitic gummatous process with a marked degree of endarteritic and endophlebitic changes. In this case a timely operation over the sensitive area of the cranium, followed by an energetic mercurial treatment, would in all probability have resulted in a complete recovery.

Stransky has recently published an excellent monograph on the subject of operative treatment in brain syphilis. He concludes that American and English authorities take the most extreme position in favor of surgical interference, Bergmann the opposite extreme, and Oppenheim, Bruns, and Henschen occupy middle ground.

In a general review of all the pertinent cases one is forced to the conclusion that there should be no hesitation in performing the operation when a positive localization is possible and antispecific treatment does not produce a quick and definite response, or if an *indicatio vitalis* exists. Of course, after the operation the antispecific treatment should be energetically continued, since it is scarcely possible that the extirpated tumor is the only manifestation of syphilis in the brain.



A multiplicity of lesions, as in non-specific tumors, would be a contra-indication against operative interference, as, for instance, the complications of a basilar specific meningitis or an extensive specific lesion of the spinal cord with the gummatous tumor.

Concerning surgical treatment of spinal-cord syphilis, so far as my knowledge extends, nothing is known. We do know, however, that spinal gummata are almost never solitary and do not usually attain a size sufficient to cause symptoms of compression, and, most important of all, they are probably without exception only an accompaniment of extensive specific spinal changes.

The treatment of metasymphilitic affections of the nervous system is justified from the standpoint of the prophylaxis and especially so since Homén and Schuster have proven that previous treatment of the lues in tabetic cases has usually been insufficient.

Dinkler in Erb's clinic found many cases of tabes in which the marked improvement following mercurial treatment did not appear as merely coincident. The opinions of the various authorities concerning the justification and necessity of mercurial and iodine treatment in true tabes is as yet divided. For a number of years I have taken the position that every case of tabes in which there is a history of lues, and since the beginning of the tabetic symptoms has not been thoroughly treated with mercury, should receive such treatment without further delay. If no marked improvement results from the treatment, or the disease does not appear to have been stopped in its progress, it ought not to be repeated.

I have had for many years a large number of cases of tabes under observation which apparently by the inunction treatment were brought to a quiescent state and have been kept in this condition by repeating the treatment once every one or two years. These are cases of gastric crisis, lightning pains, slight ataxia, bladder disturbances, etc. I have also numerous cases of abortive tabes under observation which have not developed but have remained as rudi-

mentary cases. Because of these experiences I can by no means agree with those who reject mercurial treatment in *tabes dorsalis*.

Erb's conclusions on this question are as follows:

1. In *tabes* with a positive history of syphilis antisyphilitic therapy is indicated, with careful adaptation, of course, in each case.

2. Specially suitable are all the recent cases of *tabes* in which the syphilis does not date too far back.

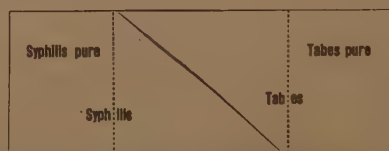


FIG. 97.—Minor's schematic representation of the justification and importance of antisyphilitic therapy from the time of the syphilitic infection to the complete development of *tabes*.

3. Further, all the cases in which florid symptoms of syphilis can be demonstrated on other parts of the body or which are complicated with symptoms of cerebral or meningeal lues.

4. Finally, all the cases, old cases as well, which at the time of their syphilis received insufficient treatment.

E. Redlich, as the result of a large clinical experience, in 1910 came to the conclusion that an energetically repeated mercurial treatment in syphilis exerted a favorable influence towards preventing the development of *tabes*, but that it could not be regarded as a certain prophylactic measure. He also believes that mercurial treatment in *tabes* itself is without effect, but in early cases, however, it sometimes appears to induce a benign course and perhaps even bring the progress of the disease to a condition of quiescence. Also in acute relapses it seems at times to have a good effect. Mercury in such cases is always to be administered in moderate doses. Very often, in fact too often, however, it completely fails and seems entirely unable to stop the advance of the disease or to prevent the appearance of such severe symptoms as optic atrophy or the development of a *taboparesis*.

Some authorities go still further than Erb and recommend enormous doses of mercury in the form of inunctions (15 to 20 grammes *pro die*). I can only agree with Erb in regard to the large doses and consider their administration a mistake. It may be repeated here that general tonic and constructive measures, such as hydrotherapy, electricity, massage, and constructive medication, should follow the inunction treatment.

In many cases very good results have been obtained by me in combining the mercurial treatment, whether in the form of inunctions or injections, with injections of fibrolysin. These were especially cases of marked cerebral and spinal paralyses which did not respond well to mercury and iodine alone. In cases of gummatous meningeal brain lues after twelve injections of fibrolysin I have seen the paralysis disappear. The fibrolysin is put up in ampules and one ampule is injected every four or five days.

The treatment of congenital lues is practically the same as for the acquired form. Mercury and iodine are the specifics. Mercury should be given to children by preference in the form of sublimate baths or in the form of calomel internally. Iodine plays a more important rôle in congenital than in acquired syphilis. In no case of disease of the nervous system due to congenital syphilis should the administration of iodine be neglected. The doses of both mercury and iodine must, of course, be adapted to the age of the patient.

The postsyphilitic affections in congenital syphilitics should be treated also in exactly the same manner as the same disease after acquired syphilis. It is particularly important in children of luetic parents who have manifested no symptoms of nervous syphilis to carry out a prophylactic nerve hygiene whether the children have or have not shown any evidences of neuropathies.

## XIX

### SALVARSAN THERAPY

**Introduction.**—A special article has been requested by me concerning the administration of salvarsan. The recollection of the great sensation that this therapeutic agent which Ehrlich brought out after painstaking examinations and experiments is still fresh in our memories. An enormous clinical experience has been produced and such a voluminous literature collected in the last three years that it is almost impossible to review. However, the work of testing the therapeutic value of salvarsan has been pursued with such vigor that at the present time we are able to determine in the main what its chief advantages and disadvantages are; in other words, what can be expected of it and what cannot.

**Dangers.**—The dangers which accompany its administration we are able now to say are slight, provided the remedy is given with a proper technique and in the proper doses.

**Intramuscular and Subcutaneous Injections.**—In regard to the technique, the large intramuscular and subcutaneous injections which represented the earlier methods of its administration have been abandoned. Experience has shown that by these methods of administration salvarsan was very painful, often caused long-continuing and sometimes permanent indurations, and not infrequently produced stubborn suppurations and necroses. It was uncertain as to dosage because one could never determine how much of the injected remedy was going to remain unabsorbed, deposited as in a depot, in the centre of the induration.

The numerous injurious effects, in the form of sciatic and peroneal paralyses and bladder disturbances, which have been ascribed to it, should be attributed to the technique and not the remedy. Smaller doses are still given intramuscularly.



Isaac, in Lassar's clinic in Berlin, has reported good results with weekly intramuscular injections containing 0.1 gramme of salvarsan in each injection.

**The Intravenous Method.**—Salvarsan at the present time, however, is administered far more often intravenously. The advantages of this method are: (1) exactness in dosage; (2) absence of pain; (3) quicker distribution of the remedy throughout the entire system; and (4) the certainty of obtaining an effect from the entire dose.

There are no dangers in this form of administration if (1) the remedy is injected in either an alkaline or neutral solution; (2) if careful asepsis or antiseptis is observed; (3) if care is taken to prevent the entrance of air-bubbles into the veins; and (4) if it is not given in severe cases of arteriosclerosis, extensive nerve degenerations, advanced cases of diabetes, and in general marked cachexias, such as exist in tuberculosis and carcinoma. The danger which has been said to exist in aneurism and myocardial degeneration, according to my experience, has been overestimated.

The following illustration represents the apparatus which has been used in my clinic for the intravenous injection of salvarsan. This apparatus was devised by Dr. A. Hauptmann, assistant in the clinic. The apparatus is so arranged that at any time either the salvarsan solution or a salt solution can be allowed to flow into the vein. It is extremely important that one may be able to determine at first whether the needle is really in the vein or not by a trial test of permitting the salt solution to flow first. In thin veins especially one is quite apt to puncture both walls of the vein. Even a small quantity of the salvarsan solution under the skin will cause considerable pain and induration and may lead to necrosis. If the salt solution flows into the vein without any subcutaneous infiltration, then the salvarsan may be allowed to flow, and when it has flowed in to the amount of the required dose which one wishes to give, then the salt solution should again be turned on and allowed to flow until the salvarsan has been washed out of the tube and vein at the point of injection.

The apparatus is constructed in the following manner: Two glass upright cylinders are fused upon a small horizontal cylinder, into which is fitted a ground glass stop-cock

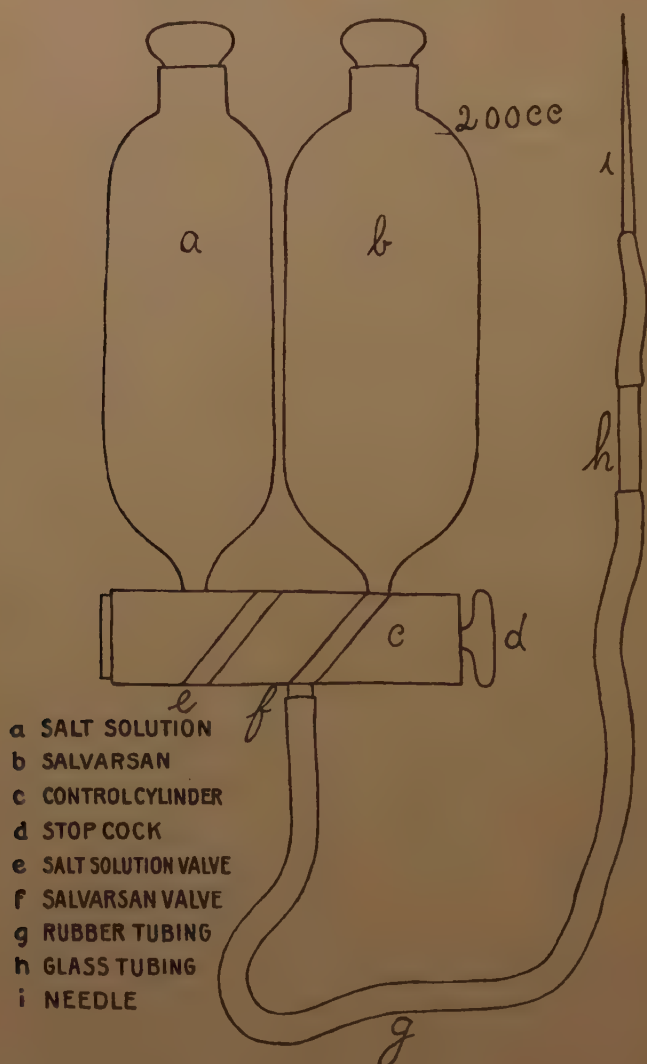


FIG. 98.

which is bored through in two places. These openings in the stop-cock are so arranged that when one of them is patent with the cylinder containing salvarsan, salvarsan

flows, and when the other opening is patent with the cylinder containing salt solution, salt solution flows. Turning the cock once around is all that is necessary in order to change from the salvarsan to the salt solution. The cylinder for salvarsan is graduated up to 200 c.c., the one for salt up to 100 c.c.

The salvarsan solution may be mixed in the salvarsan cylinder by shaking the powder in about 100 c.c. of a hot salt solution made from distilled water. This solution is then increased by the addition of more salt solution of the same character and then a 15 per cent. solution of sodium hydroxide is added, drop by drop, until a precipitate is formed and the whole solution resembles an emulsion. One then continues to add the sodium hydroxide, drop by drop, shaking up the solution well from time to time, until it becomes perfectly clear. The solution is then either neutral or alkaline and ready for administration without testing. If, however, any particles are seen floating in it, it should first be filtered through sterile cotton before giving. At the opening on the bottom of the horizontal cylinder a rubber tube is attached, which contains on its other end the needle, and just behind the needle there is inserted a small glass tube. The glass tube in this position enables one to see that all the air is out of the apparatus and also helps one to ascertain when the vein is punctured rightly by the backward flow of blood into the tube. At the first appearance of blood in this tube the ligature around the arm should be released instantly. One of the large veins at the elbow should be selected by preference for the injection of the salvarsan solution. If the veins in this locality are not suitable a vein may be utilized in any other part of the arm or leg where one is found that is accessible. The ligature should be placed around the arm just above the elbow, rather tight, in order to congest the veins, but not tight enough to shut off the pulse at the wrist. This ligature should be tied in such a manner that it can be quickly released. Directing the patient to make a fist causes the veins to stand out still more prominently and thus makes them easier of access for puncture. The needle should be directed as nearly horizontal with the vein

as possible in order to avoid puncturing the opposite side of the vein-wall. Oftentimes, either on account of the thinness of the veins, or a venosclerosis where the vein is so resistant that it continually rolls out from under the needle, or because the vein is so covered by fat that it cannot easily be located, it is best to cut down on the vein and plainly expose it. This can be done by using a 1 per cent. solution of novocaine for local anæsthesia. It is much better to do this than to continue making futile attempts to enter veins with resistant walls or those lying deep in the tissues and difficult to palpate.

**Complications Following the Administration of Salvarsan.**—After the administration of a dose of salvarsan the patient should remain in bed 24 hours; then if no fever develops he may get up and resume his customary occupation. Sometimes considerable fever, the temperature rising as high as 103° or 104° Fahrenheit, follows the administration of salvarsan intravenously. Such cases are exceedingly rare, however, and may be almost entirely avoided if freshly distilled water is used in the making up of the physiological salt solution. The water impurities, to which alone Wechsellmann wished to attribute the complications following the administration of salvarsan, has been shown by Finger, and also by Westphal from recent experimental examinations, not to possess the importance which Wechsellmann desired to give to them. Now and then cases of diarrhœa, vomiting, and a scarlatina-like rash still occur, which, however, because of their comparative infrequency and freedom from danger, should not be regarded as of much importance.

**Is Salvarsan Injurious to the Nervous System?**—The question as to whether salvarsan in itself is injurious to the nervous system deserves special attention. While Ehrlich in his first publications had cautioned against the use of salvarsan in well-advanced processes of nervous degeneration, he maintained that the remedy for a healthy nervous system was harmless. In the very beginning, the medical profession, because the remedy was an arsenic preparation and because of their recent experiences with atoxyl, were



suspicious of its influence on the optic nerve. Robert Koch, in his extensive experience with atoxyl in treating the sleeping-sickness, demonstrated its influence on the optic nerve to be unusually harmful. I made the first pathological examination in two optic nerves, as well as the primary centres of vision belonging to these nerves. The case was one of inoperable metastatic carcinoma of the uterus, in which atoxyl had been administered subcutaneously daily in ordinary doses. It has been determined that salvarsan is not injurious when the optic nerve is intact, and also that non-specific disease of the optic nerve appears to progress no faster after the administration of salvarsan than before.

On the other hand, since the beginning of the salvarsan era, disease of the acoustic and facial nerves appears more often than before. Finger, of Vienna, was the first to call our attention to this and attributed the more frequently occurring paralysis of these cranial nerves directly to the toxic effect of salvarsan.

At the annual meeting of the German neurologists, in October, 1911, at Frankfort-a.-M., an extensive discussion took place between the advocates and the opponents of Ehrlich's remedy. Shortly before this meeting fatal cases as a result of encephalitis, cases of acutely developing spinal paraplegia, and many cases of peripheral neuritic paralysis, had been reported. It was also shown at that meeting that cases of primary and secondary syphilis could not be *primo ictu* cured by salvarsan, that a "therapia sterilisans magna" in the sense of Ehrlich could not be accomplished. At that time cases of the so-called (neuro-recidivè) relapses in nervous tissue had already been published by Geronne, Gutmann, Dessneuse, Dujardin, Assmann and Nonne, in which the examination of the spinal fluid by the presence of lymphocytosis, Phase I, and the Wassermann reaction in the spinal fluid had proven that these were cases of true brain syphilis. The fact that the (neuro-recidivè) nervous recurrences in general disappear under salvarsan and mercurial therapy is another proof that they are cases of brain lues. Since then Klineberger,

Dreyfus, Yaloziceky, and others have confirmed this opinion. At the present time the consensus of opinion in regard to the nervous recurrences may be expressed as follows:

More often than formerly since the introduction of salvarsan in the therapy of syphilis of the nervous system one sees various paralyses of the cranial nerves. A portion of these paralyses is only apparently of more frequent occurrence, because since the beginning of this salvarsan controversy the acoustic nerve, and particularly its labyrinthine branches, have been much more carefully observed than heretofore. One must admit that salvarsan is able to render spirochæte foci mobile or active which otherwise perhaps might have remained latent. According to Ehrlich's opinion these latent foci are found particularly in those places where the salvarsan solution is impeded in its circulation and as a result of this the remedy is able to attack the spirochæte only to a limited extent. For example, the various bony canals and foramina through which the cranial nerves course offer suitable conditions for preventing thorough contact of the spirochæte foci with the salvarsan.

The adherents of Ehrlich say that this quality of salvarsan to arouse a latent cerebral lues out of its latency and cause it to become active is an advantage, because one in this way learns of the position of the enemy. On the other hand, the opponents assert that an organically specific diseased organ, and especially an organically specific diseased nervous system, possesses the tendency to relapses, and that therein lies the danger of salvarsan, that a state of permanent quiescence has not been produced.

**The Influence of Salvarsan on Syphilogenetic Diseases.**—The innumerable reports concerning the effect of salvarsan in the last four years permit us to say that the specific syphilitic affections frequently are very favorably and speedily influenced, but that tabes and paresis show no material change in their clinical course. There are authorities who in incipient cases of tabes and paresis have observed a condition of quiescence or stand-still and very marked remissions in both of these affections, but, on the other hand,

other observers have reported only unfavorable results, more marked progression and the appearance of new symptoms directly following the administration of the salvarsan.

Concerning the influence of this remedy on the four reactions, the following can be said:

In true cerebrospinal syphilis, if the case recovers clinically the four reactions gradually become lessened in intensity and may entirely disappear. These cases are the ideal cases, of which I have seen a large number.

In tabes and paresis the influence of salvarsan on the four reactions is slight or none at all, and this is true not only for the cases which are progressive and show no improvement, but also for those which manifest clinically improvement and even quiescence. Even here parasyphilis behaves differently from specific syphilis. Taking everything into consideration, it must be said that advantages which are free from objection cannot be ascribed to salvarsan that mercury does not also possess. One must admit that where quick effect is necessary salvarsan is to be preferred, but, on the other hand, it should be strongly emphasized that where vital centres are affected, such as the medulla and the upper cervical cord, salvarsan is contraindicated. This view must be taken since A. Westphal and Stertz reported their case of meningomyelitis of the cervical cord, which under salvarsan therapy was transformed into an acute condition that may be regarded as the Herxheimer reaction, and caused the death of the patient.

It should be acknowledged that salvarsan in many cases exercises a general tonic action.

**Recapitulation.**—Summarizing it can be said at present that in cerebrospinal syphilis in individual cases a quicker and more far-reaching result may be attained with salvarsan than with mercury and iodid. There are also cases in which salvarsan is effective after mercury and iodid have failed or had an insufficient effect. The cases in which salvarsan has had an entirely favorable effect, however, are in the minority. In by far the greater number of cases the superiority of salvarsan over mercury and iodid is not

apparent. In cases of gummatous disease of the central nervous system immediate salvarsan treatment may be said to be specially indicated. In specific disease where the vital centres are involved it is especially contra-indicated.

**Tabes Dorsalis.**—Salvarsan may in general be given, in tabes, in those cases where mercury is indicated, also in cases where no antispecific therapy has been administered since the beginning of the spinal-cord affection. Whether salvarsan is to be preferred where the disease is rapidly progressive in character, or symptoms of irritation are a prominent feature, has not as yet been determined. It is probably indicated in those cases in which a certain degree of cachexia sets in early. It is also to be recommended as well as mercury in cases that, under the chronic intermittent treatment, have run a benign course.

Optic atrophy is not a contra-indication, providing small doses are given. Contra-indications are found when the disease affects the upper cervical region and the medulla oblongata where the vital centres are situated.

That salvarsan is of any more value in tabes than mercury has not as yet been proven.

**Paresis.**—The treatment of incipient cases of paresis with salvarsan is permissible. In those cases where mercury has had a favorable influence, but where it seems no longer to benefit, salvarsan is to be recommended. In advanced cases where mercury has been tried without effect the administration of salvarsan is useless. In advanced cases, contrary to Ehrlich's first warning, salvarsan may be given without injury.

Up to the present time no case of so-called (neuro-recidivè) nervous relapse has been reported in a case of paresis. Cases have been reported, however, in which, shortly after the treatment with Ehrlich's remedy, severe maniacal symptoms have suddenly appeared which made necessary the confinement in an institution of the previously free patient. This experience has occurred twice in my practice. This excited state, however, as is well known, is apt to occur in any case of paresis, either with or without treatment. It must be said that the most observations in



this affection are of a too recent date to draw definite conclusions in regard to them. For instance, one observer writes: "In a lady in whom paresis was diagnosed within a period of ten days a complete recovery took place."

The consensus of opinion at the present time is that salvarsan is no more of a cure for paresis than mercury and iodid. Cases have been observed in which marked improvement has followed soon after the treatment, in which the speech and hand-writing, and in fact the entire mental state, appeared to undergo a decided change for the better. There are no cases reported, however, in which the improvement has been any more marked than many experienced practitioners have seen before the salvarsan era.

**Dosage.**—In the beginning of our experience with salvarsan large doses, 0.6, 0.8, 1 gramme, were given and repeated three or four times. Later smaller doses, 0.2, 0.3, 0.4 gramme, were administered once every seven or eight days and repeated four or five times. For the last two years the combined treatment of salvarsan and mercury has found the most favor. One combines at present the salvarsan injection with mercurial inunctions and calomel injections. Recently Dreyfuss, in Frankfort-a.-M., has recommended again large doses of salvarsan. He administers in a period of from five to eight weeks as much as 5 grammes of salvarsan. In the intervals between the salvarsan infusions he injects large doses of calomel. Since Dreyfuss has observed no injurious results from this treatment, and since he has worked using as control the lumbar puncture, and the reactions in the spinal fluid have been favorably influenced, this method of treatment is worthy of trial. At the present time I am using this treatment in my department at Eppendorf, but thus far have formed no conclusions. I can say this much, however, that up to the present time I have not seen any progression of the symptoms in any patient who has been under this treatment.

Neosalvarsan, a more recent preparation, has the advantage in that it may be dissolved in a much smaller quantity of water than salvarsan. A full dose 0.9 may be dissolved in from 20 to 30 c.c. of distilled water and injected intra-

venously. One of its disadvantages is that it is subject more easily to decomposition. On this account quite a few authorities advise against its administration. Natrium salvarsan, a still more recent preparation, is said to have all the advantages of neosalvarsan without its disadvantages. Salvarsan may be either directly or indirectly introduced into the spinal canal. Marinesco, in 1911, injected serum from syphilitics, with disease of the spinal cord, who had previously been treated with salvarsan, directly into the spinal canal.

In 1913 M. Robertson applied the same method in the treatment of paresis.

The procedure of Swift and Ellis is very well known.

Swift and Gander experimentally proved that the blood serum of syphilitics, treated intravenously with salvarsan, possessed a very positive therapeutic value, also, that the spirochætocidal power of the serum is greatest soon after the injection of the salvarsan.

The technique of this treatment is as follows: One hour after an intravenous injection of salvarsan or neosalvarsan of from 0.3 to 0.5 Gm., 40 c.c. of blood is drawn directly into a sterile centrifuge tube and after the clot has formed centrifuged. The clear serum is then pipetted off into a sterile glass container, firmly stoppered with sterile cotton, and set upon the ice until the next day. It is then heated in a water-bath at a temperature of 56° C. for half an hour. Twelve cubic centimetres of the serum is diluted with 18 c.c. of a normal salt solution, making a 40 per cent. solution, and introduced into the lumbar part of the spinal canal. At subsequent injections, the amount of the serum may be gradually increased and the salt solution decreased, using 15 and 18 c.c. of serum and 15 and 12 c.c. of salt solution, respectively. The undiluted serum is also given without causing symptoms of irritation. This is the indirect method of administering salvarsan into the spinal canal. After making a lumbar puncture, spinal fluid is drawn off until the intraspinal pressure is reduced by 30 mm. water. Practically, one can judge of the pressure by the flow of spinal fluid from the lumbar puncture needle and, accordingly, as the flow is rapid or slow, from 20 to 30 c.c. of fluid should be withdrawn

before the serum is introduced. The best means of administering the serum is by gravity. A 30 c.c. Luer or Record glass syringe, a rubber tube from 14 to 16 inches in length, with connections which fit snugly at one end into the lumbar puncture needle, and at the other the syringe, complete the equipment. Sufficient salt solution is poured into the syringe to force all the air out of the tube, which is then clamped at its distal end with an artery forceps. The 30 c.c. of serum and salt solution is then poured into the syringe and the distal end of the tube is connected with the needle, the artery forceps removed and the syringe elevated the length of the tube. Gravity is almost always sufficient to cause the serum solution to flow into the spinal canal. If in any instance it is not, the piston may be inserted into the syringe and gentle pressure made sufficient to force all the solution out of the syringe. After the injection, the foot of the bed in which the patient lies is elevated for several hours with the idea of facilitating the flow of serum in the spinal canal towards the brain.

I have treated 30 cases of brain and spinal cord syphilis according to this method. In one case there occurred a serious heartcollapse, in another an abducens paralysis and a hemiparesis; otherwise, there were no bad after-effects. I soon combined this method of giving salvarsan with courses of mercurial inunctions. In 23 cases of tabes and paresis in which the method was used over a period of from three to six months no demonstrable progression of symptoms was observed in a single case. The four reactions showed either no change or only such as one sees in other methods of specific treatment.

In one case a surprising improvement occurred. A man thirty-two years old had contracted syphilis eleven years before. His previous treatment had not been thorough. The past seven years he has suffered with lightning pains in the legs, chest and back. Objective: Anisocoria, loss of pupil light reaction in the right eye, sluggish reaction in left eye. Romberg, absence of patellar and Achilles reflexes, hypalgesia and delayed pain transmission in the lower limbs. Four reactions typical.

This patient received 24 mercurial inunctions of 4 Gm. each, together with 4 intraspinal injections of salvarsanized serum. Two months after the termination of the treatment, subjectively the patient was fine. The patellar and Achilles reflexes on both sides were obtained without Jendrassik. The light reaction of the pupil, left normal, right still sluggish but plainly present. No disturbances of sensation. Romberg negative; no pains.

Six months later, patellar and Achilles reflex present with Jendrassik; pupil, light reactions on both sides sluggish, subjectively normal.

I have observed, as other authorities on tabes now and then, the return of the pupil reaction and the deep reflexes under mercury and salvarsan, but a disappearance of such a series of tabes symptoms, as in this case, I have never seen before. Otherwise in the cases treated by me, according to this method, of tabes, paresis and cerebrospinal lues, I was unable to notice any difference in their course than in cases treated by the usual methods.

**Direct Mode of Administration of Salvarsan and Neosalvarsan.**—In 1912 Wechselmann injected neosalvarsan directly into the spinal canal in cases of paresis. Ravaut combined the injection of neosalvarsan intraspinally in doses of from 3 to 6 mg. with the intravenous injection of salvarsan. While, on the one hand, Ravaut reported good results with this method, Sicard was not successful with this treatment. Sicard and Reilly, by means of local anæsthesia, trephined the skull and injected the neosalvarsan under the arachnoidea cerebri. Levaditi, Marie and Martel trephined paretics over the frontal bone and administered the salvarsanized serum between the dura and the frontal lobes of the brain. More recently, Marincesco in cases of tabes and paresis injected serum salvarsanized *in vitro* both intraspinally and intracerebrally. The dose of the salvarsan in these injections was from 6 to 12 mg. and they were given every 7 or 8 days. In 20 cases so treated Marincesco saw no bad results. He also observed no particular benefit from it.

Gennerich recommends in all stubborn cases of nerve



syphilis endolumbal treatment. He injects every three weeks from 6 to 8 c.c. of a solution of 0.15 neosalvarsan dissolved in 300 c.c. of normal salt solution, mixed with equal parts of spinal fluid. In 67 cases so treated, he saw no serious disturbances. I have had some success with Gennerich's method, but nothing more than I have observed as occurring in similar patients either without treatment or as a result of treatment given according to the customary methods. Cimal recommends dissolving the neosalvarsan in the spinal fluid. He administers in this manner 3 mg. of neosalvarsan. Larger doses cannot safely be given. Ampules containing 0.045 gramme neosalvarsan obtainable from Merck are dissolved in 3 c.c. of spinal fluid. By means of a graduated pipette 0.2 c.c. of this solution (3 mg. neosalvarsan) is added to 10 or 15 c.c. of fluid which has been allowed to run into the glass syringe connected with the rubber tube attached to the lumbar puncture needle, by depressing the syringe; the syringe is gently shaken to mix the spinal fluid and neosalvarsan and then elevated so that the spinal fluid, plus the neosalvarsan, will flow by gravity into the spinal canal. I have treated 30 cases by this method and have observed no bad effects as a result. I regard it at the present time as the best means of giving salvarsan intraspinally. Weygandt and Jacob, in a series of experiments on monkeys where they injected neosalvarsan solutions in varying strengths intraspinally and under the dura, came to the following conclusions: The circulatory conditions in the central nervous system are good for salvarsan, concentrated solutions are dangerous, but weak solutions, in small quantities, may be given without injury.

In 1914 Byrnes, of Johns Hopkins, reported a number of cases of cerebrospinal syphilis which he had treated successfully with injections of mercurialized serum. From 1/50 to 1/30 gr. of bichloride of mercury is dissolved in 5 c.c. of freshly-made, sterile normal salt solution. This is added to 20 c.c. of serum taken from the patient in the same manner as the blood for the salvarsanized serum. This solution of serum and mercury is then heated in a water-bath at 56° C. for one-half hour, so that an albuminate of mercury may be formed.

This mercurialized serum is then injected into the spinal canal at body temperature. These injections are repeated usually at intervals of from two to three weeks, depending upon the reaction and the clinical behavior of the case.

Whether the endolumbal treatment of syphilogenetic disease of the nervous system, be it by the direct method of Ravaut, Gennerich and Cimbäl, or the indirect one of Marincesco, Swift and Ellis, is more effective than the intravenous is as yet not determined. Communications of Eskuchen, Weygandt, Cimbäl and V. Schubert, as well as my own experiences, are not convincing. A longer period of observation will be required before definite conclusions can be formed.

**The Administration of Both Mercury and Salvarsan.**—Wechselmann has advised against the use of both mercury and salvarsan at the same time, since in his opinion this combination is injurious to the kidneys. Experience is, however, against Wechselmann's position. As to whether the mercury in combination with the salvarsan should be given in the form of inunctions or of injections of soluble or insoluble salts is a matter to be decided largely by one's own personal experience. My usual mode of procedure is as follows: Inunctions of 4 Gm. each of unguent ciner. are rubbed in for four days in succession. The fifth day the patient takes a bath, the sixth day rests, on the seventh day salvarsan is administered intravenously. The eighth day is another rest day and the ninth day the series begins again. I begin with 0.3 salvarsan and either keep to that dosage or increase to 0.4 when I desire to obtain a stronger effect, and where no reaction to the smaller doses has occurred I sometimes give 0.5 salvarsan. In this course of treatment I give from 32 to 40 inunctions and from 3 to 4 Gm. salvarsan. When the 4 reactions become negative in any case of cerebrospinal syphilis I advise the patient to remain under observation, that is, to present himself for examination every year. If the reactions become positive, I, of course, repeat the treatment, but consider one absolutely justified if the reactions remain negative in giving the treatment again as a measure of safety.

In the light of our present knowledge the treatment of syphilis of the nervous system cannot be separated from the treatment of meta- or paralyzes of the nervous system.

INTENSIVE METHOD.—Relatively good results by the intensive method in the treatment of tabes and paresis have been reported by Leredde, Donath, Dreyfus, and Citron.

Dreyfus begins his treatment with small doses of salvarsan, 0.29 every second or third day; when no reaction occurs, he increases the dose gradually up to 0.4 Gm., which he gives twice weekly. The total dosage of salvarsan is from 4 to 5 Gm. in the first course; in the following course from 3 to 4 Gm. The duration of a course is from 6 to 8 weeks. Mercury is given along with the salvarsan and the following forms may be administered. Inunctions (a 3–6 Gm.), embarin every second day, 0.03 Gm., oleum cinerum (40 per cent.) every fifth day 0.05–0.09 Gm. Hydrarg. salic. 10 per cent. every fourth day, 0.05–0.1 Gm., calomel 40 per cent. every fourth day 0.03–0.05. Enesol 0.06 every second or third day. When the mercury is well tolerated, the combination of mercury and salvarsan is more effective than salvarsan alone. Between the courses of treatment usually eight weeks intervene. Potassium iodid should be given in the interim.

I have treated 50 cases of tabes, paresis and cerebrospinal lues according to this method. It have not observed any bad effects as a result of the treatment. The influence on the clinical course and the four reactions varied greatly. In general the effect of this treatment did not differ essentially from what one usually sees after other methods of treatment.

My position at the present time is this: Every case of tabes, except the cases which are far advanced, should receive specific treatment. If the patient is benefited by the treatment, that is in the course of the next nine or twelve months, there has been no progression or there is an improvement, the treatment should be repeated and I continue this plan one year after another.

To treat the tabetic specifically with only short pauses between the courses until the Wassermann in the blood and

spinal fluid is negative, I believe at present not to be a very promising procedure. In my opinion, in spite of the specific means which stand at our disposal, the Wassermann reaction in tabes, often, yes usually, remains refractory. It would seem at present in the treatment of tabes the doctrine of "*ne nocere*" is in danger of being forgotten. The same may be said with still stronger emphasis concerning paresis. In general I treat paresis according to the same principles as tabes. In paresis I think more caution should be used than in tabes, because the cases which react against the antisyphilitica "paradox" occur more frequently.

**Tuberculin and Tuberculin Mercury Treatment of Wagner von Jauregg.**—It is an old observation which dates back to Hippocrates and Galenus that infections and pus formations influence psychoses favorably. Quite recently many observers, V. Halban, Haenel, Briand, Rouby and others, report recoveries and marked improvements in paresis and cerebrospinal lues after infections and pus formations. V. Wagner in 1900 and 1901 treated 69 cases of paresis with tuberculin. He began his treatment with 0.01 old tuberculin and every 48 hours repeated the injections. Where the reactions were not too severe at each injection he gave double the dose of the preceding injection until the dosage of 0.1 Gm. was reached. In order to judge of the success of this treatment the clinical course of the treated cases was compared with the clinical course of a like number of untreated cases. The cases for treatment and control were selected solely according to their time of entrance into the hospital. Since the cases were asylum cases they were mostly advanced ones. Pilez reports concerning the result of this experiment. When the cases treated were compared with the cases untreated as to length of life, the treated cases showed a longer length of life (8 to 5); they also showed more and longer remissions. As a result of further experience with an improved technique with this tuberculin mercury treatment v. Wagner reports very favorably. There are few cases which do not show an improvement. Some get marked remissions complete enough for them to return to their former occupations. In 1911 Pilez reported 86 cases which were



so treated in 1907-1909. Of these 86 cases 23 improved so much that they were able to resume their work; 9 were able to return to their families and mingle with their friends again; in 20 the advance of the disease was stopped; 34 showed no change. In May, 1913, Pilcz again reported on these cases; 21 were still living; 7 were still at their work; 4 were with their families and 5 in good physical health; the ability to work lasted in one case 5 years; in 5 cases, 4 years, in one case 3 years.

Concerning the method, v. Wagner says: "The initial dose of the tuberculin in cases in which there is no suspicion of tuberculosis is 0.01 of Koch's old tuberculin; in cases which may be tubercular 0.001. If there is no reaction from this smaller dose one proceeds at once with either 0.005 or 0.01. If a fever reaction occurs with 0.001, the treatment is either abandoned or continued with milligramme doses, increasing very carefully.

For the increase of the dosage, v. Wagner adopted the following scheme: Temperature by the former dose under  $37^{\circ}$  C., the next dose is doubled; temperature  $37$  to  $37.5^{\circ}$  C.,  $1\frac{1}{2}$  times the previous dose; temperature  $37.5$  to  $38^{\circ}$  C.,  $1\frac{1}{4}$  the dose; temperature over  $38^{\circ}$  C., the previous dose is repeated. The dose is increased until 0.1 Gm. is reached which, as a rule, requires from 8 to 15 injections. He gives the injection in the back over the shoulder blades subcutaneously. The injections are given usually every second day. In those cases where the temperature is not normal, or nearly so, at the time, he postpones the injection to the third day. The mercury is given either in the form of inunctions, 30 in number, and of 3.0 to 4.0 Gm. each, or hydrarg. succinimid, 0.02 *pro dosi*, every second day until 25 injections are given. The course of mercury may either proceed or follow the course of tuberculin. Pappenheim and Volk have examined the four reactions both before and after the tuberculin treatment in cases of paresis. In all the cases examined (15) at the beginning of the treatment the four reactions were positive. After the treatment the cell content in the spinal fluid in all the cases was improved, in 3 cases becoming normal; likewise the globulin reaction, which,

also, in 3 cases became negative. The spinal fluid Wassermann was improved in 8 cases, in 3 becoming positive only with 0.5. The Wassermann in the serum in 12 cases which were examined was improved in 4, in one case becoming negative. As a therapeutic result, v. Wagner reports that in initial cases the mental condition seldom failed to improve, also, in such cases very frequently the remissions were so complete that the patients returned to work; even in far advanced cases he observed frequently marked improvement and sometimes complete remissions. The tuberculin treatment has only been given for a comparatively short time but v. Wagner among his patients has 3 with complete remissions of between six and seven years' duration; Pilez 7 cases of from three to five years' duration. v. Wagner says that the number of cases in which after a one- or two-year, or still shorter, remission relapse is very great, but in these cases a repetition of the treatment very frequently brings another remission.

**Sodium Nucleinate.**—Donath uses sodium nucleinate to produce fever, pus formation and leucocytosis in his cases and reports marked improvement, remissions almost like cures, long-continued cessation of any progression of symptoms and partial disappearance of organic symptoms. The sodium nucleinate is given in the following manner: 2.5 Gm. sodium nucleinate is dissolved in 100 c.c. normal salt solution. The initial dose is 40 c.c. of this solution injected intramuscularly into the buttocks. The injections are given at intervals of five days and increased by 20 c.c. at each injection. When the dose of 100 c.c. has been reached, the solution is increased in strength by the addition of .5 Gm. sodium nucleinate at each injection, until the maximum dose of from 4 to 5 Gm. is given. Temperature increases of from 38.5° to 40.5° C. and leucocyte counts of 15-23,000, sometimes more, may be produced by this method.

**Vaccine, Dölken.**—Dölken obtained success in the treatment of tabes with various vaccines, such as the polyvalent staphylococcus, the pyocyanase and the pyocyanus vaccine.

Plaut combines the sodium nucleinate treatment with salvarsan. He gives it at intervals of eight days, 0.2, 0.4,

and then, four times in succession, 0.6 salvarsan, follows this with sodium nucleinate 0.2 Gm. to each injection for a period of two months, then repeats both the salvarsan and sodium nucleinate courses. I have used the methods of both Wagner von Jauregg and Donath in a large number of cases, some of which date back three, some two, years. Concerning results superior to the former methods of treatment I am unable to report. One is, however, certainly justified in pursuing this line of therapy further. Wagner von Jauregg recommends also the combination of some fever-producing agent as tuberculin, sodium nucleinate, bacterial vaccine, etc., with specific treatment in the therapy of the so-called true syphilogenetic nervous diseases.

At the present time the danger exists through the Wassermann reaction, the spinal fluid examination, the finding of spirochætæ in paresis and tabes, that the natural and reasonable impetus therapeuticus of the neurologist may degenerate into a furor therapeuticus. Formerly old and experienced physicians said that if in six weeks mercurial treatment did not bring about a recovery or a marked improvement, the disease was refractory to treatment. Now among the French, Ravaut is the chief exponent of the view, and among the Germans Dreyfus, Wechselsmann and Citron recommend that it is advisable to continue the treatment until the spinal fluid becomes normal. All who have had a large experience know that many tabetics by "hands off" feel very well and also that many tabetics and paretics do not bear well very energetic procedures. The above-mentioned method is absolutely logical, but it seems to be doubtful whether here theory and practice agree. It is well known that the spinal fluid in tabes and paresis behaves differently in response to treatment than it does in the "true syphilitic nervous disease." Leredde's explanation of this difference, that the treatment is neither long enough or intensive enough, is certainly simple, but its truth has not yet been proven. As examples that with pathological spinal fluid reactions a tabes may continue absolutely benign and stationary in character, I will cite here two cases out of a larger number of similar ones.

Case of rudimentary tabes in man sixty-seven years old. Loss of pupil reaction to light, absence of Achilles tendon reflexes every three or four months, severe lightning pain for the past 20 years. Four years ago Wassermann in blood + + +. Wassermann in spinal fluid from 0.6 on + +. Lymphocytosis. Phase I, + +. In twenty years two systematic courses of inunctions, the last five years ago, one year before the examination. At present, subjective, excellent condition, objective, no change.

A man sixty-two years old, tabetic for 15 years; mercurial treatment 12 years ago. Since then no specific treatment. The tabes is of the imperfect or rudimentary type, loss of pupil light reflexes, absence of the tendon reflexes of the lower extremities Hitzig zone. Four years ago Wassermann in blood + + +. Wassermann in spinal fluid + + with 0.5 c.c. Phase I +. Lymphocytosis +. At present four reactions essentially the same. Objective symptoms, unchanged; subjectively, good.

The following case shows how careful one should be in the valuation put upon the specific treatment of paresis and how cases of paresis are always turning up of long-continuing remissions without any specific treatment:

A musician, forty years old, with no knowledge of a specific infection was for two years abnormally irritable. He consulted me on account of a neuralgia of his left arm which he acquired by too much use in violin playing. He had loss of the pupil light reaction in both eyes, a suggestion of articulatory speech disturbance, increase of the tendon reflexes, depression; within the next few weeks a typical expansive paresis developed; delusions of grandeur, psychomotor excitement; uncleanness in urine and fæces. Wassermann reaction in blood + + +. Wassermann reaction in spinal fluid by 0.2 c.c. +. Phase I + + +. Lymphocytosis + + +. The patient was sent to the asylum at Friedrichsberg. He was there eight months. The diagnosis was dementia paralytica. No specific treatment was given there. At the end of eight months he was discharged apparently fully recovered. For the past year and one-half he has performed his regular work in an excellent manner. Recently



I again examined this patient. The right pupil reacted normally to light; the left sluggish. The tendon reflexes were still active. Wassermann reaction in blood + + +. In liquor up to 1.00 c.c. negative. Phase I +. Lymphocytosis +.

Finally there is still the question as to whether individuals who belong to families where there is cerebrospinal lues, tabes or paresis and themselves manifest no nervous symptoms, but whose blood shows a positive Wassermann, should be treated. This question cannot be definitely answered. Those who think that this reaction by no means proves that such persons are actively syphilitic but only that at some time have been, do not advise treatment. On the other hand, those who think (at present they are in the majority) that this reaction proves the presence of active spirochætæ will govern themselves according to the individual case and the station of the case. E. Hoffman, who in the modern syphilis therapy stands strongly with the last mentioned, admits that a positive Wassermann alone is not necessarily an indication for specific treatment and that many with infections dating back many years and positive blood reactions continue permanently in good health. In such cases I advise the patients to take moderate doses of potassium iodid according to the chronic intermittent method. In case, however, it is decided to treat such patients energetically with mercury or salvarsan, or a combination of both, it is wise to inform them that the treatment is necessary, although it may produce no change in the blood reaction.

**Salvarsan in Congenital Syphilis.**—As mercury and iodid are administered in the same way in congenital syphilis as in the acquired type, so also the indications for salvarsan in both these forms of syphilis are the same.



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